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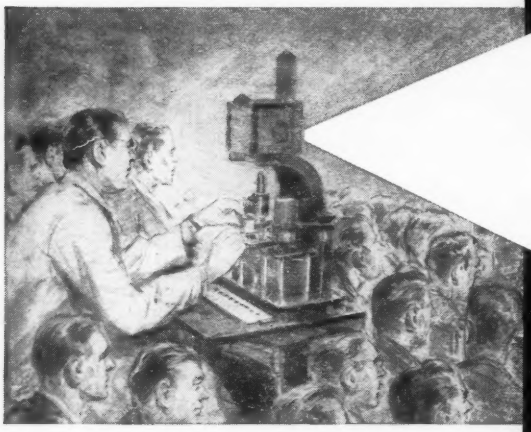

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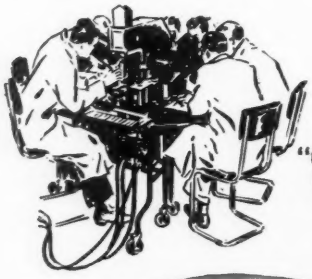

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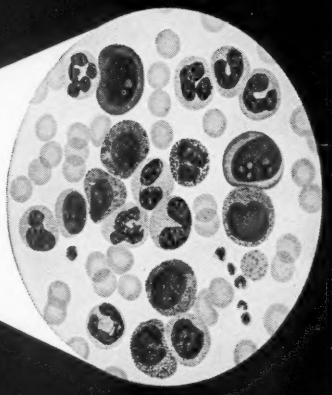

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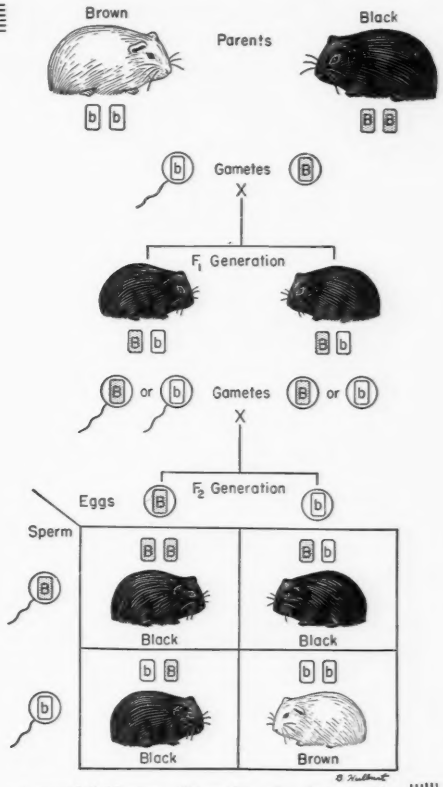

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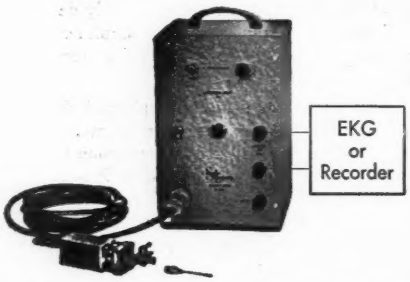

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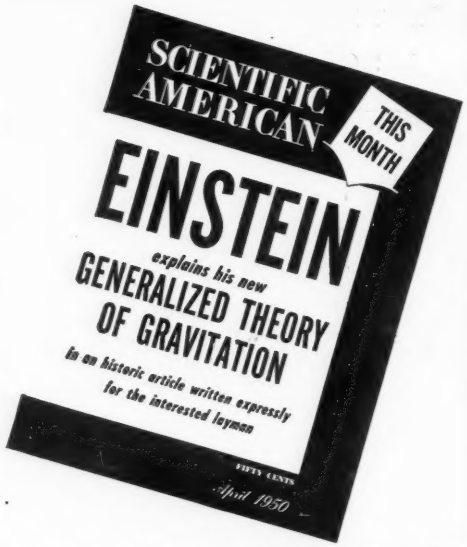

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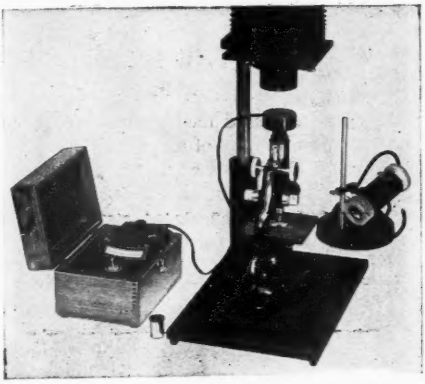

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DURING THE PAST TEN YEARS considerable progress has been made in determining the seismicity in a given area—the frequency of occurrence, and distribution of earthquakes. Earlier investigations were based almost completely on field observations, but now extensive use of instrumental records is possible. This assures much more uniform results for the whole earth. The use of seismograms in investigations of seismicity was made possible by the development of methods which permit a rapid calculation of a function of the earthquake energy from instrumental observations. The first seismogram of a distant earthquake that was recognized as such was made on April 17, 1889, when an instrument at Potsdam wrote a record identified as that of a shock in Japan. During the following years instruments were designed which gave fairly good records of distant earthquakes. In 1897, a committee of the British Association for the Advancement of Science called attention to the desirability of observing earthquake waves that had traveled great distances. By 1899, thirteen stations provided such observations and the results were analyzed. In 1904 the number of stations reporting had increased beyond one hundred, but less than half of them reported wave arrival times reliable within about a quarter-minute. From that time on, however, it has been possible to locate within a few hundred miles all great earthquakes and most major shocks. In 1907 the International Central Station at Strasbourg issued the first catalogue giving all readings for the larger shocks reported for 1904. Thus, starting with 1904, research on seismicity could be based on instrumental observations. The systematic publication of such data was discontinued during the first world war (when the catalogue for 1908 was in press) and later was resumed, starting with the data for 1918. For the years 1912 to 1917 summaries for selected shocks were published. Detailed data concerning arrival times of waves at the reporting seismological observatories are printed in the "International Seismological Summaries." In addition, these volumes contain calculated values of the coordinates and depths of the earthquake foci and the origin times of the shocks. They were formerly compiled at Oxford, England, and now at Kew. The summaries are based on the bulletins that are issued by most seismological stations. Some of these station bulletins contain in addition to observed times of various phases the calculated amplitudes of the ground motion. With this information, it is possible to determine the size of the earthquakes. The great importance for research of all such station bulletins and international catalogues is obvious.

There are now roughly three hundred seismological stations with accurate time service (at least to the nearest second) practically all over the world, including South Africa, South America, New Zealand, Samoa, Australia, and Madagascar in the southern hemisphere, and a much denser network in the northern hemisphere.

Until about ten years ago the size of an earthquake could be estimated only from the observed size of the area of perceptibility or of damage or from changes found at the surface of the earth. Arbitrary scales were applied to such data to find the *intensity* of a shock. For example, in the scale used in the United States, intensity II indicates that the shock was felt only by a few persons; intensity V, that it was felt by everyone, many were awakened, some dishes were broken, etc.; intensity VIII indicates slight damage in specially designed structures, considerable damage in ordinary buildings, great damage in poorly built structures; and intensity XII, the maximum, indicates destruction of all structures. A scale of wholly different nature, based on instrumental data, was devised by C. F. Richter in 1935. He defined *magnitude* of an earthquake at average (shallow) depth in southern California as the common logarithm of the maximum trace amplitude expressed in thousandths of a millimeter, with which the standard short period torsion seismometer (period 0.8 seconds, magnification 2800, damping nearly critical) would register that earthquake at an epicentral distance of 100 kilometers. Magnitude $M = 2$ corresponds in shallow earthquakes to a shock barely felt; a shock of magnitude 5 causes minor damage; magnitude 7 is the lower limit of major earthquakes; $8\frac{1}{2}$ is the highest magnitude that has been determined from amplitude data given in individual bulletins of seismological stations since 1904. This magnitude scale was later extended by Gutenberg and Richter to apply to shallow earthquakes occurring in other localities and recorded by other types of instruments. In 1945 Gutenberg devised means for determining magnitudes of shallow earthquakes using amplitudes and periods of waves that had traveled

through the interior of the earth. He also extended the scale to include deep focus earthquakes. It is now possible to determine the magnitude of larger earthquakes within a few tenths of the scale from seismograms at any well-equipped station. The relationship between magnitude M of an earthquake and its energy E in ergs is given roughly by the approximate equation $\log E = 12 + 1.8\,M$. This holds for any focal depth. The data concerning the magnitude and the instrumentally determined epicenters and depths of foci of earthquakes provide the basis for seismicity studies.

The results of such an investigation of earthquakes recorded over the period from 1904 to 1947 has been published by Gutenberg and Richter in a book, *Seismicity of the Earth,* published by Princeton Press in 1949. Much of the following information is taken from this book.

The use of magnitudes for the first time provides reliable information concerning the relative seismicity of all regions of the earth. It eliminates the effects of density of population and of communication facilities on the determination of intensities of reported earthquakes, as well as effects of uneven distribution of seismological observatories on seismicity patterns. If the magnitude of the earthquakes is not considered, distorted appearance of seismicity maps may result from an accumulation of many small shocks, which are plotted only in regions well covered by stations with sensitive instruments. Thus, Europe—which, except for the Mediterranean area, has a low actual seismicity—has appeared on maps in the past as a region of relatively high seismic activity. There are now five stations reporting magnitudes of earthquakes in their routine bulletins, but many more regularly furnish amplitude data required for the magnitude determination. Magnitude can be determined from a seismogram at any station where instrumental constants are known and where a clear record of an earthquake has been written, regardless of the distance or depth of the shock. Magnitudes determined at different stations rarely differ by more than one fourth from the average for a given earthquake.

The outer part of the earth consists of relatively inactive blocks, separated by active zones falling into four groups: (1) the circum-Pacific zone, which includes about 80 percent of all shocks with origins at a depth not exceeding 60 kilometers (about 40 miles), 90 percent of the so-called intermediate shocks, which have their sources at depths between 60 and 300 kilometers (about 40 and 190 miles), and all deeper shocks (maximum observed depth approximately 400 miles). (2) The Mediterranean and trans-Asiatic zone, which includes nearly all remaining intermediate and large shallow shocks. (3) Narrow belts of shallow shocks, which follow the principal ridges in the Atlantic, Arctic, and Indian Oceans. (4) Moderate activity associated with rift structures such as those of East Africa and the Hawaiian Islands.

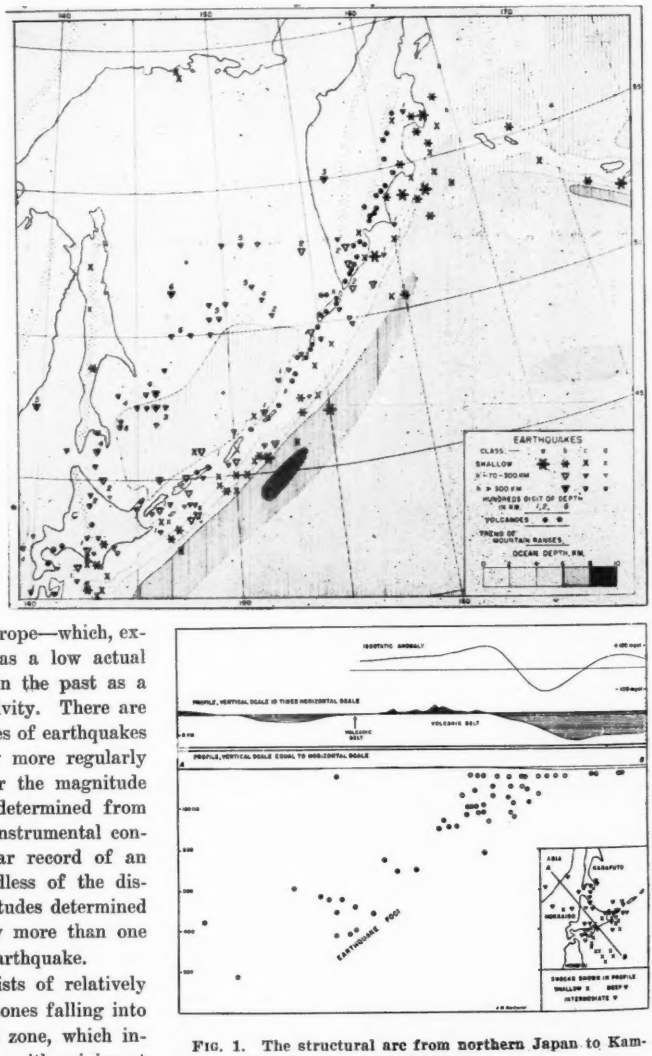

FIG. 1. The structural arc from northern Japan to Kamchatka, after Gutenberg and Richter.

The most extensive inactive block is the Pacific basin (excluding the Hawaiian Islands). On the continents, most of the ancient shields are quite inactive. Between the stable shields and the active belts are regions of minor to moderate activity having occasional large shocks. Small shocks (magnitude 5 and less) apparently occur everywhere.

A structural arc of the Pacific region—for example the Tonga arc, the Marianas arc, or the northern Japan arc—exhibits the following typical features in order, beginning at the convex side: (A) a foredeep; (B) shallow earthquakes and negative gravity anomalies along anticlines; (C) positive gravity anomalies and slightly deeper shocks; (D) the principal mountain arc (Tertiary or older), with active volcanoes and shocks about 100 kilometers deep; (E) an older structural arc with volcanism in a late stage or extinct, and shocks about 200–300 kilometers deep; (F) a belt of deep shocks (below 300 kilometers). In some arcs only a few of these features can be identified; this is true of the similar structural arcs along the southern Alpid front of the trans-Asiatic zone. In parts of the Pacific belt (for example, along the coast of the continental United States and British Columbia) structural arcs and the accompanying features are absent. In many such sectors (as in California) there is strong evidence of block faulting in place of the folding characteristic of the arcs.

The seismicity of North America is mainly associated with the Pacific belt. Relatively high activity occurs in the area of the Aleutian Islands. The Aleutian arc is a typical Pacific arc; it extends from the Commander Islands into central Alaska. Seismic and volcanic activity is relatively high. In general, shallow seismic activity follows the northern concave side of the Aleutian trench. Intermediate shocks at depths down to about 100 miles occur along the north side of the island arc. No shocks originating deeper than 200 miles are known in the area of the North American continent. The shocks having depths of approximately 60 miles occur near the line of volcanoes, as usual. Shallow shocks in the interior of Alaska represent an interior structure.

Another sector of the Pacific belt extends from southeastern Alaska to Puget Sound and includes the rather active area of the Queen Charlotte Islands, where a great earthquake occurred in August, 1949. There are neither well-developed ocean deeps nor shocks at intermediate or greater depth in this area. The seismic activity decreases considerably in the vicinity of the state of Washington. There is a clear gap between this and the next seismic zone, which begins about 200 miles off the coast of Oregon. Thence, an uninterrupted belt of earthquake foci extends in a southeasterly direction. It reaches the coast of northern California, then follows the coastal area to the region of San Francisco and continues inland following the well-known San Andreas fault zone. This zone has been traced at the surface as far south as the Salton Sea, but the earthquake belt continues along the Gulf of California at least as far as the southern tip of Lower California. Volcanic activity is low along this zone; the few volcanoes, such as Mount Lassen, and Tres Virgenes in Lower California, appear to be in a late state of activity.

The next sector to the southeast is one of noticeably higher activity. It follows the Pacific Coast from Colima in Mexico to Panama. There are two lines of active volcanoes, one extending west–east across central Mexico from Colima to Vera Cruz, the other beginning in Guatemala and extending southeastward through Central America. Accompanying the line of active volcanoes, once more earthquakes are found at depths of somewhat less than 100 miles. Mexico City is in the west–east belt of intermediate shocks and consequently experiences rather frequent earthquakes; however, they usually cause relatively little damage as a result of their considerable depth below the surface. Ocean deeps off the Mexican coast are well developed and include the Acapulco deep and the Guatemala trench. Unfortunately, gravity measurements are very scarce off the whole Pacific Coast of North America but the few data available indicate appreciable negative gravity anomalies, at least off the coast of Mexico in the neighborhood of the ocean deeps.

The earthquake belts mentioned thus far are responsible for most of the seismic activity in North America. In the United States, for example, the California–Nevada region contains about 90 percent of the whole seismic activity. This result is based mainly on instrumental data covering the past 40 years, but is in good agreement with historical information. The remaining shocks are partly situated in areas marginal to stable masses, partly in regions which have undergone higher tectonic activity in the not too distant geological past. The Rocky Mountains and related structures, which are of the same age as others belonging to the circum-Pacific belt, show relatively low seismicity.

Other regions with occasional earthquakes include the area between Siberia and Alaska. This is transgressed by the Bering Sea, whose coasts are probably of structural significance, since practically all the known shocks of the regions are close to them. Activity marginal to the Canadian shield includes a major earthquake off Newfoundland in 1929; to the northeast, marginal shocks have occurred in Davis Strait and Baffin Bay. There is notable activity along the St. Lawrence River.

The Appalachian belt is a region of fairly frequent minor activity. The northeastern part of it is shaken occasionally by marginal shocks of the Canadian shield, and some moderate earthquakes originate within the Appalachian area. Near the Atlantic coast is the epicenter of the Charleston (North Carolina) earthquake of 1886. Historically the greatest shocks in the United States outside the Pacific area are the earthquakes of 1811 and 1812 in the Mississippi Valley, which originated near New Madrid (Missouri); their magnitudes possibly surpassed magnitude 8. It is of interest to note that shocks east of the Rocky Mountains seem to originate occasionally at depths of about 30 or 40 miles below the surface, which is near the lower limit of "shallow" earthquakes. As a consequence, these shocks are sometimes felt over a wide area without doing any serious damage anywhere. An earthquake near Charleston (Missouri), in 1895 occasioned only minor damage near its epicenter and yet was felt from the District of Columbia to New Mexico, from Canada to Louisiana. Contrasting with these shocks, California earthquakes usually originate at a depth of approximately 10 miles; even when they cause considerable damage, they have much smaller areas of perceptibility.

The instrumental data furnish information as to the contemporary seismicity of any given region. However, the historic records where available indicate that in most areas the seismicity changes only relatively little with time; on the other hand, a few regions are known to have shown a much higher seismic activity in earlier periods, and in some instances major earthquakes have occurred in regions which have been considered inactive. Of the roughly one million earthquakes per year which are potentially strong enough to be felt somewhere on earth (magnitude 2 and more) about 2 percent occur in the earthquake belt of California and Nevada (including the shocks off the coast of northern California and Oregon).

It is possible to make certain statistical statements about the frequency and the probability of the occurrence of earthquakes within relatively large areas over long periods of time. For example, of the present average of about 220 great shocks ($M \geqq 7\frac{3}{4}$) and about 1,200 additional major earthquakes ($M = 7.0$–7.7) per century over the whole earth, about 5 and 18 respectively can be expected to occur in the Pacific United States, about 14 great shocks and 65 major shocks in Alaska and the Aleutian Islands, and about 11 major shocks in the remainder of central, eastern, and northern North America. It is not possible, however, to predict the approximate location or time of larger earthquakes, since too little information is available on the sources of energy and the processes involved in the building up of strain leading to an earthquake.

Some information on tectonic processes is being furnished by geodetic measurements. The U. S. Coast and Geodetic Survey has installed a special system of triangulation stations and bench marks in California, which are checked from time to time. In this way, changes in elevation as well as horizontal movements over larger areas are found. Such measurements have indicated, for example, that during the past 60 years the region on the west side of the San Andreas fault between San Francisco and San Jose has moved roughly 10 feet north relative to the east side. This is not a new type of movement; geological evidence indicates that this type of movement has persisted during many centuries, at least. Wherever rivers flow across the fault system the river bed has been displaced in the same direction—the western side northward relative to the eastern side. The total amount of these displacements is not known. In the neighborhood of the San Andreas fault some offsets exceed one mile; however, no information concerning displacements in excess of the distances between successive valleys can be found in this way. Thus far no definite correlation has been found between rocks corresponding to each other on the two sides of the San Andreas fault.

Records of earthquakes have been used to find the direction of the movement at the source and to draw conclusions as to the fault movement during a shock. It is possible to determine whether the first motion of the longitudinal waves is from the source toward the station or in the opposite direction. Thus, for example, earthquakes along the San Andreas fault to the north of Pasadena begin on the Pasadena records with a dilatation toward the source, whereas earthquakes from the San Andreas fault to the east of Pasadena start with a compression toward Pasadena. The motion in the shear waves can be investigated in a similar way. Studies of this type, which have been undertaken in California during recent years, have fully confirmed the persistence of the movements just described. They throw some light on the details of the processes in earthquakes.

It is of interest that similar investigations seem to indicate that in Japan, in the Philippines, and in New Zealand the prevailing movement is such that the continental side is also moving southward relative to the Pacific side. However, the data are insufficient for a more general conclusion as to movements of the continents relative to the Pacific block.

Additional information on processes leading to earthquakes can be expected from investigations on the relation of earthquakes and aftershock sequences to rock creep, which Hugo Benioff is undertaking. On the basis of the elastic rebound theory, the fault rock strain relief which produces an earthquake is propor-

tional to the square root of the energy. Consequently, in a sequence derived from a single fault system the square root of the energy of each shock represents a strain release (or increase) increment, and a plot of the accumulated sum of such increments against time represents the motion of a fault as a function of time. The method thus appears to provide a means for observing tectonic movements in progress. The energy is derived from magnitudes of earthquakes as determined by Gutenberg and Richter. In the case of aftershock sequences, Dr. Benioff has found that creep curves exhibit either simple compressional elastic creep of the fault rock or compressional elastic creep release followed by shearing elastic creep release.

Study of a number of earthquake sequences occurring in all the active regions of the world has revealed that most of them form creep series. Many types of creep are represented, such as constant velocity creep, exponential velocity creep, elastic creep, and elastic flow creep. Individual sequences may have linear extents of 20° to 30° of latitude, as in the case of the South American and Tonga sequence, and the evidence strongly suggests that they are derived from movements of single mechanical units. The deep focus Tonga sequence exhibits elastic creep which continued some 25 years, thus demonstrating that at depths of 650 kilometers rock masses can support elastic creep stresses without appreciable flow for many years. Unfortunately, data available for this type of research cover too short a period to permit conclusions to be drawn as to the exact processes involved. In some of the series investigated by Dr. Benioff, discontinuities in the rate of movement were observed within the short interval of time during which instrumental records are available. Other sequences appear to exhibit no evidence of a discontinuous change in rate since 1904.

Still another type of approach could start with stresses to be expected from theoretically derived forces—such as those connected with contraction or expansion of the earth, or subcrustal currents—and their effect on geological structures. All ideas dealing with forces and structures are by far too controversial to permit the drawing of conclusions concerning expected seismicity, but data obtained from earthquakes and artificial explosions are at present the most reliable basis for hypotheses connected with tectonic and structural problems. The distribution of earthquakes and the other observed phenomena in the Pacific are structures leave little doubt that there is a great difference between the structure of the Pacific crustal layers and the structure of crustal layers in the continents and in the Atlantic.

A change in surface structure occurs at some point off all Pacific coasts. In the western and southwestern Pacific the boundary is given by the so-called Marshall line or andesite line, which separates the more andesitic material on the continental side from the less andesitic on the Pacific side. This line is known to run to the east of the Japanese, Marianas, and Philippine Islands and crosses the Caroline Islands leaving Yap and Palau on the continental side. It turns sharply to the east near the northwestern end of New Guinea and later passes between Samoa (which is on the Pacific side) and the Tonga Islands (on the continental side). Near Samoa it turns southward and remains to the east of the Kermadec Islands and of New Zealand. Its location in the eastern Pacific is not known, since no islands can be used there for locating the line, but it appears to follow along the coast of North America at a distance which varies from place to place. The andesite line is the intersection of a deepgoing surface of discontinuity with the surface of the earth. The difference in structure on its two sides provides one of the reasons for the accumulation of earthquakes along the line. The fact that in many areas a belt of large negative gravity anomalies parallels the andesite line indicates tectonic processes extending to rather large depth. The deep focus earthquakes are connected with these processes, and the fact that the very deep shocks occur nowhere on earth except near and inland of the andesite line is another indication of the unique structure of the Pacific basin.

All information available for the Atlantic side of North America indicates that the transition from the continent to the bottom of the Atlantic is rather gradual. Although granitic material is probably missing in the deeper parts of the Atlantic basin, as shown by recent seismic explorations by W. Maurice Ewing and his collaborators, *deeper* continental material may be present throughout the bottom of the Atlantic Ocean. In contrast with the Pacific coasts, there are no earthquake belts surrounding the Atlantic or the Indian Ocean. However, earthquakes and volcanoes occur along the mid-Atlantic ridge. In contrast with this ridge and similar ridges with seismic activity in the Indian Ocean, no ridges of the Pacific show any earthquake activity, with the exception of the area near the Hawaiian Islands.

There is no agreement on any hypothesis as to the ultimate source that furnishes the energy for earthquakes. Perhaps they are connected with differences in heat production in the various units of the earth's crust. Laboratory experiments indicate that much more radioactive heat is generated in granitic material than in the more basic material (simatic rocks) of the deeper layers and much less in the ultrabasic material which probably extends relatively close to the surface in the Pacific area. There is, in addition, the effect of the temperature difference between ocean

bottom (which is kept at a temperature near 0° C by the deep water in the oceans) and the temperature of roughly 200° C at the corresponding depth under the continents. Subcrustal currents may be a consequence of this horizontal temperature gradient. This may be combined with the fact that the structural arcs along the Pacific boundary are usually interpreted as due to forces either pushing or drawing subcrustal material downward toward the foredeeps, with compensating movements elsewhere. However, we know too little about the details of these processes.

During recent years it has been a very common experience in geophysics that hypotheses concerning the structure and the processes in the earth's crust have become less and less certain as data accumulate; frequently the fact is revealed that the approximations used were not as good as was believed. There is little doubt that the number of recognized unsolved problems is increasing rather than decreasing in practically all fields of geophysics. The hope of explaining and predicting earthquakes seems to be more remote now than at any previous time.

Ray Lyman Wilbur: 1875-1949

Robert E. Swain

Stanford University, California

RAY LYMAN WILBUR, chancellor of Stanford University, died on June 26, 1949. A heart infection contracted about five years before had impaired his health and caused him to lead a more cautious life, yet up to within a few days of his death he went regularly to his office in the Hoover Library, maintained an active interest in public affairs and in Stanford University, and kept up with an extensive correspondence.

Dr. Wilbur was of English ancestry. His forebears came to Massachusetts in early colonial days, fought in the Revolutionary War, and were prominent in the life of the Commonwealth. One branch migrated to the Roger Williams Colony in Rhode Island; the next generation moved on to western New York; and the grandfather of Ray Lyman Wilbur went thence to the Western Reserve, which became Ohio. His father was born there, grew up in time to serve in the Civil War, studied law at the University of Michigan, married and, in keeping with the ancestral tradition, moved on westward to Boonesboro (now Boone), Iowa, where Ray Lyman Wilbur was born on April 13, 1875. Eight years later the family went to the new settlement at Jamestown in the Dakota Territory, and thence to Riverside, California, in 1887.

Graduating from the Riverside High School at seventeen, young Ray entered Stanford University with the class of '96, having chosen Stanford "because it had no ivy on its walls." He was tall and lank, six feet four inches in height, and had a marked resemblance in stature and countenance to young Abraham Lincoln. The nationwide depression of the nineties, and a failure in the orange crop in southern California, threw him largely on his own resources to work his way through the university. An early employment as a laboratory assistant in his major department, physiology, helped out.

He soon became acquainted with a young sophomore majoring in geology, named Herbert Hoover, who was also working his way through Stanford and roomed in the same men's dormitory, Encina Hall. Both had native qualities for leadership and teamed up on various student body issues, and thus began a close friendship which went on through life.

Wilbur graduated from Stanford in 1896, was awarded the master's degree the following year in physiology, and received the M.D. degree in 1899 from the Cooper Medical College (later to become the Stanford Medical School) in San Francisco. He was an instructor in physiology at Stanford (1896–'97) and an assistant professor (1900–'03). He engaged in postdoctorate work in medicine in Frankfurt-am-Main (where he worked for a time in Paul Ehrlich's laboratory) and in London (1903–'04), and at the University of Munich in 1909–'10. After a few years of private practice in Palo Alto he became professor of medicine in 1909 and the first dean of the new Stanford University Medical School in 1911—a position which he resigned to accept the presidency of Stanford in 1916.

In the ensuing three decades he rose to eminence in three broad fields of human endeavor: in the medical sciences, in higher education, and in public affairs. In each separate field, the service he rendered was distinguished enough to give him high rank among the men of his time.

In medicine he rose rapidly in influence as a teacher, practitioner, and administrator. His lectures were models of clear, precise statements, backed by a sound knowledge of the fundamental sciences, and sparkling

with homely epigrams. He had an almost uncanny ability in diagnosis, often picking up some obscure symptom as the key to a startling revelation of the cause of the illness of a patient. Dr. Wilbur once told me that one of the finest compliments he ever received came from the Chinese cook who had served the Wilburs faithfully for many years but retired to live with his family in Palo Alto when Wilbur took over the presidency of Stanford. One day upon returning from a trip east he found his old servant, anxiously waiting for him on the train station platform. He wanted Wilbur to come and see his sick wife right away. "Haven't you had another doctor?" Wilbur asked. "Yes," the Chinese answered, "I have doctor; but other doctor he come, look; you come, look, *see*!"

That old Chinese cook had put in a few words what all who knew and worked with Wilbur over the years would record as an outstanding attribute. He had quick lenses, the mental recordings were clear and sharp, and the decisions reached were sound to a remarkable degree.

Reasonable brevity will not permit more than summary reference to his work in the field of human health after he became president of Stanford. With few exceptions, as when President Harding was stricken in San Francisco in 1923, he let the curtain fall on the practice of medicine, even as a consultant, but his professional interest in medicine and human health was maintained at a high level. This is reflected by his work on a number of important commissions, and by his election to the presidency of several national organizations, one of them being the American Medical Association (1923–'24), seven years after he had given up his medical school deanship to become a university president. This is one of the greatest honors in medicine and a post of great responsibility. After the completion of his term of office he continued to exert wide influence on matters of policy and attended the annual meetings of the association as chairman of the Council on Medical Education and Hospitals. Among his last important undertakings were his chairmanship of the Baruch Committee on Physical Medicine (beginning in 1943); and his service on the Medical Services Committee of the Hoover Commission (beginning in 1948).

Particular reference may well be made to his work as chairman of the Committee on the Cost of Medical Care (1927–'32), which was financed by several foundations. This was in the pioneering days of a movement which was then, as now, highly controversial. The committee's final report, published under the title *Medical Care for the American People,* is a classic example of the way in which a broad question should be studied and reported upon. The key to its program lay in providing the opportunity, for those who chose to take advantage of it, to obtain needed medical care for themselves and their children on a local prepaid medical plan, in sharp opposition to compulsory federal control of medicine. The committee's suggested plan at first was vigorously opposed by many who regarded it as a step down the road to "socialized medicine." It lay dormant for several years, and then Wilbur took the lead in putting into effect some phases of it in organizing in 1939 the California Physicians' Service, of which he became the first president. This has had a spectacular growth and is becoming a model for nationwide voluntary health insurance programs.

Ray Lyman Wilbur was president of Stanford University for over a quarter of a century, from 1916 to 1943. The period will stand out as an epoch in the history of the university. To him a university was a company of real scholars engaged in teaching and research, and at every turn he devoted his efforts to promoting their work. Coming in as a young man forty years of age, he soon won the confidence of those older men (some of them his former teachers) who under David Starr Jordan, Stanford's first president, had helped to carry the young university through its first formative years. He built up an academic structure marked by simplicity and reasonable relief from the heavy burden of committee service by members of the faculty. New developments soon began to take shape: the adoption of the four-quarter system providing for the full use of the university all through the year; the development of self-government by the student body, with the administration of a singularly successful honor code to govern examinations and standards of student conduct; a plan of independent study under proper supervision for the exceptional student; the grouping of related departments into schools so that a student could move about more freely in the general field of his interest; and, as one of his last acts, the launching of a School of Humanities, which took on the scope of a liberal arts college; to list only a few. All have stood the test of time.

From the outset of the junior college movement in California, Wilbur was one of its staunchest advocates, foreseeing clearly the day, now long past, when the universities in this rapidly growing western commonwealth could not carry the load without weakening seriously the work which they alone are able to do in the graduate and professional years. There are today 52 junior colleges in California, with 171,865 students. Stanford faced the question boldly in 1916 by placing a sharp limitation on the number of new students who could enter in any year with less than junior year standing, thus opening the doors to many more upper division and graduate students.

Dr. Wilbur delegated many official functions freely, and let it be known that this delegation carried full responsibility. One characteristic example was when he left for Washington, to be gone four years as Secretary of the Interior. When he bade farewell in his office to the faculty member who was to serve as acting president of Stanford during his absence, he simply said: "This is now your job, not mine, while I am away in Washington. Don't mind about referring things to me. Go ahead and do them yourself. If anything should come up on which I can be helpful, drop me a line. You will have a prompt answer." For the ensuing four years that letter file is thin, and made up largely of the sender's own letters returned at once with a scrawled suggestion on the margin which never failed to go straight to the heart of the issue.

One of his striking attributes was his ability to reach a decision, clear and sharp, if the facts were at hand, with amazing swiftness. A caller at his office on some troublesome question often found that, even before he had fully stated the case, the smiling president had picked out the issue, diagnosed it clearly, and was ready with the answer. There had been no lengthy exchange of views, no wrinkling of brows. To some this had a touch of humiliation. There was an element of abruptness in his action which was not intended, nor was it put on. This attitude made him a brilliant diagnostician in medicine as well as a great administrator; but he moved too fast for some people. It was also his habit to spend no time in giving his reasons for reaching a controversial decision once it had been made. He never showed much interest in speaking in self-defense. On the other hand, he had unending patience and persistence in achieving objectives which he knew had to ripen in the minds of others and await a more favorable time, but he would not clutter up his day trying to take the whirlpools out of the stream. He could wait, as he often did, but he did not drift.

Although he was without fear, never ran away from trouble, even cheerfully taking over the troubles of his subordinates on countless occasions, and was often outwardly abrupt in his action, he had at the same time an infinite capacity for understanding to which all who knew him well will testify. He was by nature kind and tolerant and sympathetic, never bitter or vindictive or moved to anger, whatever the provocation. He never ignored or scorned opposition, and had a rare sense of wit and humor which often flashed out, unheralded, even when serious matters were under heated discussion.

Common sense was revealed in his simple phrasing and homely epigrams. Once, when asked to give his idea of the key to success, he replied, "My suggestion is this: Think before you act; keep on thinking while you act; but *act*." And, "I have always been attracted by the out-of-doors, by birds, and fish, and rough people. I have always preferred the lizard with the blue belly to the lounge lizards." Or, "Anyone can fish in a quiet and reposeful inlet, but it takes real men to fight the tides and storms where the best fish are." He liked "the smell of a campfire and the lusty cry of a healthy baby better than the easy chairs of clubs or learned dissertations."

Thus he went back to his life in open country to illumine his thinking on human problems, for he loved outdoor life. Nearly every year in late summer or early fall for over twenty-five years he went with a group of old friends into the rugged Siskiyou mountains of California, remote from any outpost, up a rocky trail by packtrain, to a log cabin on the bank of a tributary to the Klamath River. There were good fishing, deer in season, and waterfalls, deep, shady pools, companionship around a huge fireplace, and complete relaxation. He was as skillful in wing shooting as in fishing, going every year during the open season, on week-ends, to his shooting club in the Colusa rice fields along the Sacramento River, and always getting his full limit of birds.

A comprehensive, farsighted grasp of big questions is reflected in every segment of his career. For example, he was one of the founders of the Institute of Pacific Relations and chairman of the institute's first session in Honolulu in 1925. It was one of the toughest assignments ever made to any man, Chester Rowell once told me, for here were delegates representing nations with the greatest possible differences in languages, customs, and historical backgrounds. Wilbur saw clearly that more rapid intercommunication among the nations and tribes of the Pacific basin meant that this could become another world arena, staged for trouble, unless more friendly and understanding relations could be developed. He supported the institute because, as he put it, "The Institute of Pacific Relations attempts to provide a background free from the ordinary inhibitions which keep us from seeing eye to eye with the other man. It is an equal forum for equals, open, regardless of race, creed, or country, where men and women of good spirit seek to discover those things on which they can agree rather than to make a cult of disagreement." Here was a sound pattern for the promotion of international understanding. It was notably successful, and it will grow in influence as the memories of the last world war fade out; for it has had the right spiritual cast ever since its founding.

As Secretary of the Interior under President Hoover, he and "the Chief" made an incomparable team. Both had wide experience in frontier life,

were scientifically trained, were well acquainted with the vast undeveloped resources of the nation, and knew well how quickly reckless depletion would exhaust them. Almost overnight, the Department of the Interior became, in effect, a department of conservation—conservation of forests, of oil and gas, of water for irrigation and falling water for power, of animal life, particularly of the migratory waterfowl, of the vast grazing lands of the public domain of the West, and of public health. To this task Wilbur brought the same wisdom, courage, integrity, and incredible capacity for dispatching business which he had shown in university administration. His executive assistant (Northcutt Ely) tells me that the first day Wilbur walked into his office he found there a filing cabinet, four drawers deep, labeled "Suspense." His first official act was to throw it out. Matters that reached his desk in the morning were decided or referred out for action or study by night. When he was told a contract could not be closed in the six weeks available, he said that anything could be done in six weeks—you could write a dictionary if you had to. When he left office, construction on the Hoover Dam was a year and a half ahead of schedule and well within cost estimates.

Wilbur was a believer in early marriage as one of the keys to a happy and successful family life. He was twenty-three and a student in the medical school when he married Marguerite Blake, Stanford '97, and their five children were all married in their early twenties. Twenty-two grandchildren and two great grandchildren survive him.

Among Dr. Wilbur's published works are *Stanford Horizons, The Hoover Policies* (with Arthur M. Hyde), *Conservation* (with William Atherton DuPuy), *Hoover Dam Contracts* (with Northcutt Ely), *The March of Medicine,* and *Human Hopes.* In the last few years of his life he used what spare time he was able to find in working on his autobiography and had the manuscript work for it practically completed.

Many honors came to him, among them more than a score of honorary degrees; The William Freeman Snow Medal, awarded by the American Social Hygiene Association, "for distinguished service to humanity"; the title of Commander, Order of Leopold II; the Honor Cross of the German Red Cross; and the title of Chevalier, Legion d'Honneur, of France.

As Herbert Hoover has stated it, "His loss leaves a gap in all our lives. America is a better place for his having lived in it."

Technical Papers

Preliminary Note on the Occurrence of a New Protistan Parasite, *Dermocystidium marinum* n. sp. in *Crassostrea virginica* (Gmelin)[1]

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During the course of extensive investigations on oyster physiology, ecology, mortality, and histology in Louisiana and other Gulf states the authors, separately and independently, discovered a hitherto undescribed parasite of oysters. Comparison of notes and materials has confirmed that we have been observing the same parasite, and presentation of this preliminary report and a description of the parasite now seem desirable. In spite of the fact that studies have indicated a wide distribution of the organism, the authors are not aware of any previous report by investigators in the Gulf of Mexico or other regions.

The genus to which this parasite belongs was described (*8*) by Perez (1907) as *Dermocystis*. This name being preoccupied by *Dermocystis* Stafford (1905), the new name, *Dermocystidium*, was published by Perez (*9*) in 1908. In 1913 Perez (*10*) gave an extended description of the genus. Because of certain variations in morphology, the authors feel that the parasite found in the oyster is specifically distinct from any previously described species.

Inasmuch as Perez (1913), in his study of the type species, *D. pusula*, purposely abstained from designation of those characters of generic rank, as opposed to those of specific value only, there exists today no clear-cut generic diagnosis. Also it is obvious from a study of the descriptions of subsequent additions to the genus that many obscurities of cyclic development still exist—a fact which makes an attempt to designate generic characters still undesirable. The following description, therefore, omits any such analysis.

Dermocystidium marinum n. sp.

Studies of numerous stained sections and fresh preparations show that the most characteristic stage is a nearly spherical spore, 3 μ to 10 μ in diameter (Fig. 1A); the majority are 5 μ to 7 μ. Characteristically the cell contains a very large, slightly eccentric vacuole containing a large polymorphic refringent inclusion body, hereafter referred to as a vacuoplast. The cytoplasm of the cell forms a rather thin peripheral layer of alveolar nature, which is thicker on the side containing the nucleus. Occasionally the cytoplasm presents a slightly fibrous appearance and often contains aggregations of deep staining granules which are identical in staining reaction to the vacuoplast. The nucleus in the spore stage consists of a compact endosome surrounded by a clear zone usually free of chromatin material. The entire nucleus is ordinarily oval, the membrane often indistinct.

The vacuoplast, when well formed, stains in shades of gray to black with Heidenhain's iron hematoxylin and stains a very light rose or diffuse pink with Delafield's hematoxylin and eosin. Because the vacuoplast stains heavily at the surface and less deeply internally, it often has the appearance of being hollow. Morphologically it may be a nearly prefect sphere, a lobular body, branched, or beaded. Often it is represented by several separate bodies or is broken into a large number of small granules, many of which may be distributed in small subvacuoles of the cytoplasmic layer (Fig. 1A and 1D).

Occasionally binucleate stages are seen (Fig. 1C), the significance of which is not yet clear. Developmental stages of the spores usually have a vesicular type of nucleus, with some distributed chromatin and a less definite vacuole and vacuoplast (Fig. 1D).

In reproduction, segmentation of the nucleus occurs with subsequent distribution of the daughter nuclei, followed by condensations of cytoplasm around each (Fig. 1B), and this in turn is followed by cytoplasmic cleavage and final liberation of sporelike cells by rupture of the thin containing membrane. The number of such cells produced is indeterminate, but occasionally as many as thirty may result from division of a single mother cell. Their size at liberation varies greatly.

There are indications that endogenous budding occurs by a process of successive delaminations, producing spores of unequal size in an enveloping membrane formed from the parent cell. Any tissue of the host may be infected, common localizations being in the intestinal epithelium, adductor muscle, gills, mantle, and heart, or in cases of heavy infestation all tissues may be invaded. Development of the parasites is often intracellular in phagocytic or connective tissue cells.

Type host: *Crassostrea virginica*, the commercial oyster of the Atlantic and Gulf coasts.

Type locality: Sugar House Bend in the southern part of Barataria Bay, Jefferson Parish, Louisiana.

Type slides: In the collections of the authors.

The most closely related species is probably *Dermocystidium salmonis* Davis 1947 (*3*). *D. marinum* differs specifically from the latter species in (1) the extreme polymorphism of the vacuoplast, (2) in the apparent lack of a definite reproductive cycle involving simple

[1] The authors wish to acknowledge the able collaboration of Dr. S. H. Hopkins of the Texas A. & M. Research Foundation as a critic and bibliographer, and Dr. C. E. Renn, Johns Hopkins University, Sanitary Engineering Department, for invaluable criticism. Mr. Joseph Prokop, Mr. Joseph Bell, Mr. L. L. Walters, Mrs. Harry Bennett, Mr. Sammy Ray, and Mr. D. A. Wray, all assistants to the authors, have made distinctive contributions to this study.

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binary division of the protoplasm, (3) in the possession of stages in multiple cleavage not described by Davis for *D. salmonis*, and (4) by the difference in host, *D. salmonis* being parasitic on gills of the chinook salmon.

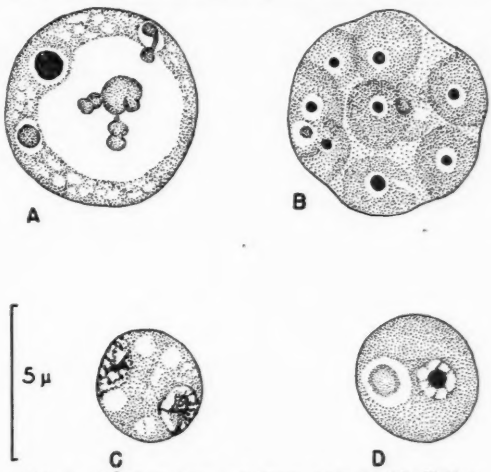

FIG. 1. Drawings from specimens stained with Heidenhain's iron haematoxylin and eosin. A—A mature spore with marked'y irregular vacuoplast, cytoplasmic inclusions, and very large vacuole. B—Multiple fission resulting in several daughter cells. C—A binucleate stage with chromatin in diffuse condition, and showing beginning vacuolation of the cytoplasm. D—An immature spore with small vacuole and vesicular nucleus. The radiating fibers from the endosome are not commonly seen.

All other described species of *Dermocystidium* have hosts confined to fresh-water environments, the estuarine environment of *D. marinum* being unique.

A small body of literature has been built up on *Dermocystidium*. At the present time the known species include *D. pusula* (Pérez) 1907, *D. branchialis* Léger (7), 1914, *D. ranae* Guyénot and Naville (4), 1921–22, *D. daphniae* Jirovec (5), 1939, *D. vejdovskyi* Jirovec (6), 1939, and *D. salmonis* Davis (3), 1947. Hosts include various species of salamanders of the genus *Triturus*, frogs of the genus *Rana*, several fishes including trout, pike, and salmon, and one invertebrate, *Daphnia magna*. All species excepting one have been reported from localities in France, Germany, and Ireland. One species only is recorded in the United States, *D. salmonis* Davis, from the Sacramento River, California.

Several closely related genera are known, but the evaluation of most of the relationships is a problem for the future. At present it seems certain that *Blastocystis* Alexeieff 1911 is the nearest well-established genus. The relationship is based on certain parallels of staining reaction of the nucleus and the vacuoplast. For an exhaustive treatment of staining reactions of *Blastocystis* see Bach and Kiefer (2), 1923, and for *Dermocystidium* see Perez (10), 1913. Also, there are definite parallels of developmental cycle including production of what Alexeieff (1) considered to be ascospores.

Data acquired thus far independently by each author show the association of this organism with dead or dying oysters under certain environmental conditions, the limits of which can be reasonably well defined. The chief controlling factors appear to be temperature and salinity, low temperature and low salinity evidently retarding the development of the infestation.

Oysters in all conditions of health are susceptible to infestation, but factors resulting in fatigue, such as spawning, and miscellaneous adverse environmental conditions accelerate the intensity and spread of the organism.

Investigations of the taxonomy, physiology, ecology, and distribution of this parasite covering the geographical range of *Crassostrea virginica* are still in progress. A full report will be published elsewhere at a later date.

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Action of Penicillin on Bacterial Utilization of Amino Acids and Peptides[1]

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In a previous communication (5), there was reported the isolation of a rodlike, Gram-negative bacillus from a contaminated solution of L-leucylglycine in 0.9% NaCl. This organism, termed strain SF, grew satisfactorily in a solution of 0.1 M L-leucylglycine in physiological saline, but did not grow when the dipeptide was replaced by a mixture of 0.1 M L-leucine and 0.1 M glycine. Only poor growth was obtained in the presence of 0.1 M L-leucine. Addition of glucose to these media did not alter appreciably the extent of bacterial growth.

The growth response of strain SF has now been studied in a more complex basal medium which contains, per liter, 5 g NaCl, 0.2 g $MgSO_4 \cdot 7H_2O$, 2 g KH_2PO_4, 2 g K_2HPO_4, and 1 ml of the trace element solution described in reference 3. Maximal growth in the presence of L-leucylglycine, dissolved in this medium, was attained at a dipeptide concentration of 0.005 M, and subsequent growth studies with the dipeptide or its component amino acids were conducted at this molar concentration for each test compound. In these experiments, Evelyn colorimeter tubes containing the test solutions (final volume, 10 cc) were inoculated with approximately 10^5 organisms, and the slanted tubes were shaken (120 oscillations per min) at 30° C. The extent of bacterial growth was measured

[1] This study was aided by a grant from the Rockefeller Foundation.

turbidimetrically in an Evelyn colorimeter (filter No. 540).

In contrast to the failure of strain SF to grow on a mixture of L-leucine and glycine in 0.9% NaCl, bacterial growth is observed when these amino acids are present in equimolar proportions (0.005 M) in the new medium. Whereas the final turbidity ultimately attained under these conditions is equal to that observed in the presence of an equivalent quantity of L-leucylglycine, growth on the amino acid mixture is considerably slower than with

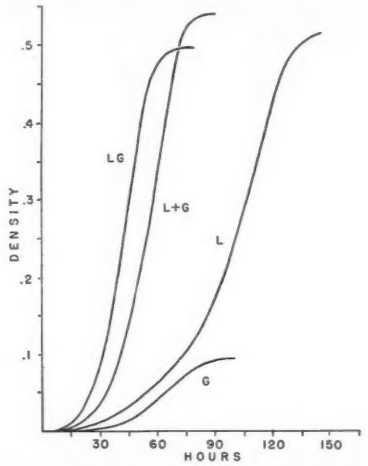

FIG. 1. Representative growth curves for strain SF in the presence of L-leucylglycine (LG), of a mixture of L-leucine and glycine (L + G), of L-leucine (L), and of glycine (G). The concentration of each test compound was 0.005 M. To facilitate inspection of the curves, the observed density readings (2-log galvanometer reading) have been omitted.

the dipeptide (cf. Fig. 1). As will be seen from the data in Fig. 1, strain SF also can grow, albeit slowly, either on 0.005 M L-leucine or on 0.005 M glycine. The comparatively small extent of bacterial growth observed with the latter amino acid may be attributed to the fact that, under the conditions of these experiments, the organic test compounds must serve as the sole sources of both the nitrogen and the carbon required for growth. When the glycine concentration is raised to 0.01 M, growth is somewhat inhibited, and complete inhibition is observed at a level of 0.03 M.

The availability of a bacterial strain which grows in a simple synthetic medium, and which shows a pronounced nutritional preference for a peptide rather than a mixture of the amino acids of which the peptide is composed, invited the examination of the influence of antibacterial agents on its growth. If antibiotics such as penicillin affected the nitrogen metabolism of this organism, this effect might be different depending on whether the organism was grown in the presence of a peptide or of the component amino acids. The data in Fig. 2 describe the result of a representative experiment in which strain SF was inoculated into media containing either L-leucylglycine or a mixture of L-leucine and glycine, together with increasing quantities of penicillin G sodium salt (Pfizer). In these tests, freshly prepared filter-sterilized solutions of penicillin were added, immediately before inoculation, to the autoclave-sterilized media.

It will be seen from Fig. 2 that while 500 Oxford units (O. u.) per ml inhibited bacterial growth only slightly in the presence of the peptide, smaller quantities of penicillin (1–10 O. u. per ml) exerted a striking inhibitory effect when the peptide was replaced by the mixture of the component amino acids.

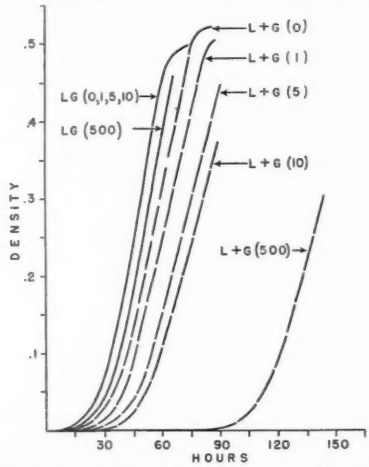

FIG. 2. Representative growth curves showing the effect of varying concentrations of penicillin on the growth of strain SF in the presence of 0.005 M L-leucylglycine (LG, solid lines) and of a mixture of 0.005 M L-leucine and 0.005 M glycine (L + G, dash lines). The concentration of penicillin, in Oxford units per ml, is given in parentheses for each curve. To facilitate inspection of the curves, the observed density readings (2-log galvanometer reading) have been omitted.

Information as to the mechanism of the inhibitory action of penicillin on the growth of strain SF in the presence of the amino acid mixture was provided by experiments in which each of the two amino acids served as the sole organic nutrient in the medium. When L-leucine was present, some inhibition was observed at 500 O. u. per ml, but not at the lower levels of penicillin employed. On the other hand, bacterial growth in the presence of glycine was markedly inhibited by 5 O. u. of penicillin per ml. This indicates that the inhibitory action of penicillin on the growth of strain SF in a medium containing L-leucine and glycine may be attributed largely to its interference with the utilization of glycine.

In view of the known bactericidal action of penicillin, it was necessary to determine the extent to which the number of viable cells originally present in the inoculum had been reduced during the early hours of the experiments in which marked inhibition of growth was observed. Plate counts were performed, therefore, on aliquots removed from the tubes at 5 hr and 10 hr after inoculation and, as will be seen from Table 1, a marked bactericidal effect in the presence of L-leucylglycine was evident with

500 O. u. of penicillin, but not at the lower penicillin levels. With the mixture of L-leucine and glycine, however, some killing was observed at 10 O. u. per ml (after 10 hr), but no appreciable effect was noted at 5 O. u. per ml. It may be concluded, therefore, that the inhibition of bacterial growth by 1–10 O. u. of penicillin per ml cannot be attributed to a bactericidal effect, but appears rather to be due to an inhibition of the utilization of glycine for growth.

In view of these results, the hypothesis may be offered that the assimilation of glycine by strain SF involves its prior incorporation into a peptide, and that the bacteriostatic action of penicillin is due to an inhibition of peptide synthesis. If this interpretation is correct, it may be hoped that further studies of the action of penicillin, and of other peptide antibiotics, on the utilization of amino acids and peptides by strain SF, as well as by other microorganisms, may serve to elucidate important aspects of the biosynthesis of peptide bonds.

TABLE 1

EFFECT OF PENICILLIN ON VIABLE CELL COUNT OF STRAIN SF

Penicillin (Oxford units per ml)	Total viable cells per tube × 10^{-6} *			
	L-Leucylglycine		L-Leucine + glycine	
	5 hr	10 hr	5 hr	10 hr
0	1.1	1.7	0.59	0.97
1	3.8	1.9	0.93	1.8
5	0.82	1.4	0.47	0.64
10	1.1	1.1	0.62	0.32
500	0.52	0.17	0.13	0.0075

* Immediately after inoculation, each tube contained approximately 1.1×10^8 cells.

Clearly, if incorporation into a peptide is an obligatory step in the assimilation of glycine by strain SF, it must, of necessity, be coupled to a process that will provide the requisite energy for peptide synthesis. Such an energy-yielding process may well be associated with the dissimilation of the carbon skeleton of the amino acids, and especially that of leucine. As has been shown by Gale and Taylor (*1, 2*), the assimilation of some amino acids, notably glutamic acid, by *Staphylococcus aureus* requires the concomitant occurrence of energy-yielding reactions. These authors also made the significant discovery that penicillin impairs the ability of this organism to assimilate glutamic acid.

It is of interest to recall the recent observation (*4*) that the dipeptide glycyl-L-leucine exerts a bacteriostatic effect on the growth of a *leucineless* mutant of *Escherichia coli*, despite the fact that the peptide can be utilized by the mutant as a source of leucine. Since the same bacteriostatic effect of the peptide on the growth of the mutant was observed in the presence and in the absence of added L-leucine, it was concluded that glycyl-L-leucine interferes with the bacterial utilization of this amino acid. These results offer an example of a simple peptide that inhibits a key metabolic reaction of a microorganism in a manner that is strikingly similar to the effect of penicillin on the metabolism of strain SF.

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Effect of 2,4,5-Trichlorophenoxyacetic Acid on Ripening of Apples and Peaches

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Blondeau and Crane (*1*) have reported that the maturation of Lob Injir (Calimyrna) fig fruits in California has been advanced considerably as a result of spraying unpollinated but pollen-receptive syconia with solutions of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T). In previously reported experiments on ripening of harvested banana, apple, and pear fruits, Marth and Mitchell (*2, 3*) found 2,4-dichlorophenoxyacetic acid to be very active. Of the few compounds tested in the present experiments, 2,4,5-T has proved to be among the most active in bringing about the fruit-ripening response of apples and peaches on the tree.

On August 23, 1948, individual tagged fruits of Rome Beauty apples and adjacent spur leaves were sprayed at the Plant Industry Station, Beltsville, Maryland, with aqueous solutions of 2,4,5-T at 10-, 100-, and 200-ppm concentrations. Fruits that received either the 100- or the 200-ppm spray concentration developed red coloration and were maturing rapidly by September 13. This same stage of maturity on unsprayed fruits was not attained until one month later, October 12, the usual harvest date for this variety. At 10-ppm concentration, the spray had no observable effect. Measurements on fruit softening were made on September 27 with the aid of a fruit pressure tester. At this time the untreated fruits showed an average pressure reading of 25.9 lb, whereas the fruits sprayed with 10-, 100-, and 200-ppm concentrations of 2,4,5-T tested 24.8, 19.8, and 18.9 lb, respectively.

The spur leaves of Rome Beauty trees that received the 200-ppm concentration were burned by the spray. New shoot growth produced in the spring of 1949 was deformed and flowers were late in opening as a result of this treatment. No injury was found in the case of the 10- and 100-ppm sprays, either on foliage present at the time of spraying or on that produced the following year.

In 1949, three early summer varieties of apples also showed a ripening effect from spray applications of 2,4,5-T to foliage and fruit. The Close variety, which matures normally during the last week of June at Beltsville, Maryland, was induced to ripen 5–7 days early by spray applications of either 50- or 100-ppm concentration applied on June 10. The fruits on branches of Duchess apple that received a 50-ppm spray on June 10 colored and

ripened 9 days earlier than those on unsprayed branches, and those sprayed with a 100-ppm concentration ripened approximately 12 days earlier than the controls. Another early variety, Williams, was sprayed on June 28 and produced ripe fruit by July 5. Unsprayed fruits of this variety were not ready for harvest until July 18.

Each of these early-season apple varieties has shown marked foliage injury at 100-ppm spray concentration, and only slight or no injury at 50-ppm. It was noted that unpicked sprayed fruits failed to drop even after the fleshy parts had decayed and fallen away. In general, the early varieties seemed to respond more quickly than did Rome Beauty, a late-fall variety, although the advance in ripening date was less.

The development and maturation of fruits of six varieties of peaches have been accelerated considerably by spray applications of 2,4,5-T to the foliage and fruit. Fruits of the Elberta peach, for instance, that were sprayed on July 1, 1949, with 75-ppm concentration of the chemical were soft and colored by July 20, although the usual harvest date for this variety is late August. Golden Jubilee peaches that received 25-ppm spray concentration on May 20 were ripe by June 27, about one month ahead of the usual time of ripening. In all instances peaches that were sprayed one month or more in advance of harvest have been misshapen and reduced in size and quality. In other experiments, when sprays were applied closer to the usual harvest period for the variety, the size and quality of the fruits were but slightly affected or not affected at all. Elberta fruits that had been induced to ripen one month ahead of the usual harvest date had embryos in the seed with well-developed cotyledons, in contrast to very poorly developed cotyledons in the seeds of untreated fruits. The evenness of ripening of peaches on the sprayed branches was in contrast with the usual unevenness on untreated branches. Redhaven peaches selected at random from branches that received 50-ppm spray concentration on July 5 showed on July 18 a range in pressure test of 6.0–9.5 lb for individual fruits, while a similar sample selected from unsprayed branches showed a pressure test variation from 9.0 to 21.7 lb. Fruits that tested 10 lb or less were soft.

In the case of peaches, marked ripening effects have been obtained with spray concentrations of 25-, 50-, and 75-ppm of 2,4,5-T. Moderate to severe damage to foliage has resulted from all applications that contained 75-ppm of this substance. A mild ripening response has resulted from spray application of 5-ppm concentration on the varieties Erly-Red-Fre and Golden Jubilee.

The use of 2,4,5-T as a fruit ripening agent is not recommended at present for commercial practice or large scale tests, since there is considerable danger of immediate or permanent fruit tree injury. Results thus far, however, show promise that warrants further careful study.

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Partogrid, Proportional Divider for Use in Paper Chromatography (Partography)[1]

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The authors' Partogrid,[3] shown in Fig. 1, was prepared as follows. Double-thickness lines (2.5-cm intervals) and triple-thickness lines (5-cm intervals) were drawn as accurately as possible with India ink on a sheet (50 cm × 50 cm) of Eugene Dietzgen's "perfect" cross section millimeter paper. Scale readings in increments of 0.1 R_f units were placed as shown on each short side of the scale. The drawing was mounted parallel to a camera lens (corrected for spherical aberration) and photographed (5 in. × 7 in. negative). Prints of three sizes (5½-, 7-, and 10-in. hypotenuses) were prepared. The Partogrid, swabbed with a solution of 25% alcoholic Carbowax 400[4]

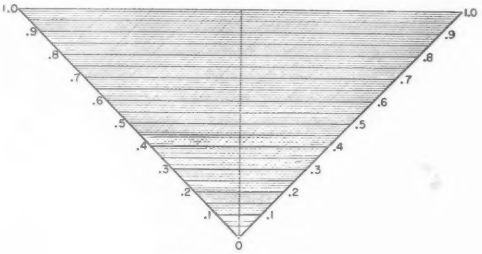

FIG. 1. Partogrid.

to increase the transparency, was mounted on an etched glass window lighted by a 100-w bulb cooled with a small fan.

A pin is inserted through the center of the initial spot (amino acid or other solute) on a filter paper strip (*4*) and the zero point of the Partogrid. The paper strip is rotated until the solvent boundary line intersects the 1.0 horizontal line on the Partogrid and the R_f values of the solute spots are read from the scale. Reliability of estimated R_f values may be increased by using both scales.

The word *chromatography* has been employed to describe the separation of substances by partition (*2*) as well as by adsorption processes. In order that these procedures may be differentiated, the word *partography* is suggested to denote the partition of colored and colorless solutes between solvents one of which may be a stationary phase. Dent (*1*) has proposed recently that filter paper partition chromatography be designated as *papyrography*. Related terms which have been suggested include *evography* (*5*) and *papergram* (*6*).

[1] Grants in support of this work have been received from the U. S. Public Health Service and the University of California.

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[3] Phillips (*3*) has described a device for the rapid measurement of R_f values but it is subject to deterioration.

[4] A polythelene glycol polymer obtained from the Carbide and Chemical Company, New York City.

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Effect of Neoplastic Tissue on the Turnover of Desoxypentose Nucleic Acid[1]

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In the course of a general investigation of desoxypentose nucleic acid turnover rates, a striking difference was found between the tissues of normal mice and those bearing transplants of mammary carcinoma.

The general plan of these experiments was similar to that used by Hevesy (*1*). The relative nucleic acid turnover rate was measured by giving a tracer dose of radioactive sodium phosphate, sacrificing the animals after 2 hr, and isolating the desoxypentose nucleic acid from the tissues to be investigated. The animals used were female A strain mice bearing bilateral transplants of Strong's mammary carcinoma.

From Table 1, it is evident that there is a very significant increase in the specific activity of the nucleic acid in the livers, spleens, and kidneys of tumor-bearing animals. The increase is proportional to the tumor size, but is not linear. For the small intestines, there is a significant lowering of nucleic acid specific activity of host animals. Tissue examinations showed no metastases.

Sodium phosphate was given intraperitoneally. The mice were sacrificed 2 hr later, the tissues were dissected out as rapidly as possible, and the isolation of the nucleic acid was begun. In order to obtain enough purified desoxypentose nucleic acid, the tissues from three animals had to be pooled.

The method used for isolation of the desoxypentose nucleic acid was essentially Levene's, as modified by Klein and Beck (*2*). Some changes were necessary to make the method suitable for a tracer experiment.

Five to 10 g of tissue was ground with sand in mortar and pestle and mixed with 10 ml of 5% NaCl solution. The tissue was then boiled in a water bath for a few minutes, 0.25 ml glacial acetic acid was added and then made basic with 0.5 g NaOH and 0.1 g sodium acetate. The basic mixture was boiled for about 1 hr, or until the organs were almost completely dissolved. One ml of glacial acetic acid and 0.7 ml of a 5% dialyzed ferric hydroxide solution were then added. After standing a short time, another milliliter of acetic acid was added and the solution was centrifuged. The supernatant was treated with an equal volume of methyl alcohol, and the crude nucleic acid was centrifuged off.

In order to purify the desoxypentose nucleic acid, it was dissolved in 5 ml of N-NaOH solution, and the following solutions were added: 0.2 ml of a saturated solution of disodium phosphate, and an equal volume of methyl alcohol. After heating in a water bath at 65° C for 15 min, the impurities were centrifuged off. The supernatant solution was placed in an ice bath, acidified with 3 molal HCl, and diluted with an equal volume of methyl alcohol. The nucleic acid was then centrifuged off. The purification was repeated six times.

TABLE 1

AVERAGES OF DESOXYPENTOSE NUCLEIC ACID SPECIFIC ACTIVITIES × 10^4

Tumor weight per animal	No. of animals	Liver*	Spleen*	Kidney*	Intestine*	Tumor*
0 (controls)	24	0.745 ± 0.06	36.0 ± 1.9	0.315 ± 0.027	15.1 ± 0.87	—
0.084 g	24	2.10 ± 0.32	57.8 ± 3.8	0.927 ± 0.132	17.5 ± 0.46	—
1.2 g	188	3.83 ± 0.19	—	—	—	25.0 ± 0.45
2.8 g	24	4.16 ± 0.49	67.2 ± 1.4	0.930 ± 0.11	13.0 ± 0.8	—

* The values given represent the number of P^{32} counts per milligram of phosphorus divided by the number of counts injected, normalized for the weight of the mice. Errors quoted are $1\sigma_M$.

After this the nucleic acid was dissolved in NaOH solution and reprecipitated with HCl and methyl alcohol four more times, and finally dissolved in about 5 ml of 0.1 *N* NaOH solution.

Klein and Beck found that the nucleic acid was pure by chemical criteria after only three repurifications. However, as can be seen from the values given here, eight to ten precipitations were found necessary in this experiment in order to attain constant specific activity of the nucleic acid upon successive reprecipitation. In a typical liver sample, the following values were obtained on aliquots taken after the stated number of precipitations.

No. of precipitations	Specific activity
3	27.1×10^{-4}
6	4.9×10^{-4}
8	3.7×10^{-4}
10	3.9×10^{-4}

Individual specific activities of tissues measured in this manner after ten precipitations show considerable reproducibility, as can be seen from the relatively small

[1] Partially supported by U. S. Atomic Energy Commission.

standard errors in Table 1. Partial purification of desoxypentose nucleic acid may include a variable amount of some phosphate contaminant of high specific activity, which would account for the variability of several orders of magnitude found in earlier studies.

The presence of mammary carcinoma transplants significantly alters the turnover of desoxypentose nucleic acid in the liver, spleen and kidneys of mice. Work now in progress indicates that the same effect occurs in Slonaker rats bearing transplants of lymphosarcoma and in pregnant rats and mice. It is suggested that the presence of a rapidly dividing tissue mass may influence the rate of cell division (as evidenced by the nucleic acid turnover rate) in the other body tissues.

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Presence of a Phosphatase in the Human Aortic Wall

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Previous failure to demonstrate a phosphatase in the human arterial wall has been a subject of some importance in the discussion of the pathogenesis of arterial calcification. A perusal of the literature shows that phosphatase activity of arterial tissue has been examined only at an alkaline reaction. For this reason a more extensive investigation covering a wider pH range was considered of interest. As the result of such studies on human aortic tissue a definite phosphatase activity with an optimum at pH 5.7–5.8 was demonstrated.

Human aortas obtained at autopsy were carefully wiped free of blood, and the adventitia and external part of the media were stripped off. The intima and residual part of the media were then cut into small pieces, and the tissue was finely ground with glass-distilled water in a Pyrex grinder. The tissue suspension was centrifuged and the supernatant siphoned off. The supernatant solution used in the experiments contained about 3 mg of protein per ml.

For the study of the phosphatase activity, citric acid sodium hydroxide (pH 3.1–7.0) and veronal sodium carbonate (pH 7.55–10.1) buffers of 0.1 molar concentration were prepared. Analytical reagents and glass-distilled water were employed in the preparation, and the pH was checked in a Coleman pH-meter. For each pH level studied, two samples, two controls, and two blanks were run at 37° C. Each sample and control tube contained 5 ml of buffer solution and 0.3 ml of supernatant solution (enzyme) whereas the blanks contained 5 ml of the buffer and 0.3 ml of water. Disodium phenylphosphate (15 mg) in aqueous solution was added at the onset of the experiments. The enzyme activity was stopped by the addition of 2.5 ml of 25% trichloroacetic acid. In the case of the controls the substrate was added after the addition of trichloroacetic acid.

The samples and controls were subsequently filtered. For color development 4 ml of the filtrates and of the blanks was pipetted off, after which 3.2 ml of 0.62 *N* sodium hydroxide, 0.8 ml of Folin and Ciocalteus' reagent, and 2 ml of 20% sodium carbonate were added. The blue color was compared in a Duboseq colorimeter with that of a phenol standard. The enzyme activity was calculated by subtracting the color value of the controls from that of the samples.

Results of studies on phosphatase activity at various pH levels are given in Fig. 1, which shows a maximum

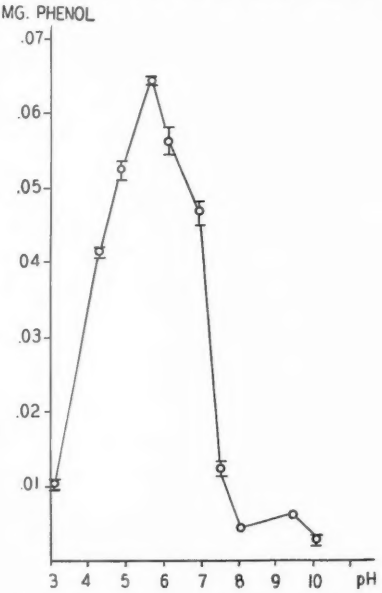

FIG. 1. The cleavage of disodium phenylphosphate at various pH levels by the supernatant of a suspension of human aortic tissue. Protein in sample, 0.9 mg; substrate in sample, 15 mg; reaction time, 30 min; temperature 37° C.

at pH 5.7–5.8. In addition to the major peak, a small peak at about pH 9.5 will be noted. This small elevation probably represents activity caused by traces of alkaline serum phosphatase, since the activity at this pH range was found to be increased by addition of magnesium chloride.

In further experiments conducted at the optimal pH (5.75), a fair proportionality was observed between the amount of supernatant fluid used (0.2, 0.75, and 1.5 mg of protein, 20-min reaction period) and the phosphatase activity, and between reaction time and cleavage of the substrate.

A comparison at pH 5.7 of the activity of aliquot samples of the original aortic suspension and of the supernatant fluid obtained after centrifugation showed a higher phosphatase activity per volume in the supernatant.

The Origin of Petroleum: Effects of Low Temperature Pyrolysis on the Organic Extract of a Recent Marine Sediment[1]

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During the course of studies on the origin of petroleum, experiments were made to determine the effect of relatively low temperature pyrolysis on an organic extract from a recent marine sediment, since it is now generally believed that petroleum originates from complex organic sediments laid down in shallow marine basins. Four samples of mud (total approximately 10 lb) were obtained from a near-shore area lying between the western end of Cuba and the Isle of Pines. The material was collected by the Standard Oil Company of Cuba at the points listed herein, and each sample was then placed in two ½-gal jars. As a preservative, butyl alcohol was added in the proportion of approximately 250 ml of alcohol per liter of mud.

Sample No. 1 (Sept. 20, 1945):

Locality—La Coloma, Pinar del Rio Province, Cuba.
Latitude—N 22° 14′ 30″.
Longitude—W 83° 34′ 20″.

The sample was collected on the west side of La Coloma Bay, at a point 30 meters inland from the coast but washed at high tide. Vegetation at the locality is mangrove trees. Sample is black mud mixed with some sand.

Sample No. 2 (Sept. 21, 1945):

Locality—Punta Gatos, Pinar del Rio Province, Cuba.
Latitude—N 22° 14′ 10″.
Longitude—W 83° 45′ 30″.

The sample of black mud was collected east of Punta Gatos, approximately 40 meters inland from the shore in a mangrove-covered swamp which is under water at high tide.

Sample No. 3 (Sept. 21, 1945):

Locality—Ensenada Las Tunas, Pinar del Rio Province, Cuba.
Latitude—N 22° 16′ 55″.
Longitude—W 83° 45′ 30″.

The sample of black mud was collected 30 m off shore in water 1.2 m deep. A mangrove thicket occurs along the coast.

Sample No. 4 (Sept. 19, 1945):

Locality—3 km west of Guanimar, Pinar del Rio, Cuba, at a locality known as Lanja de "Mangle-Prieto."
Latitude—N 22° 41′ 50″.
Longitude—W 82° 40′ 50″.

The sample of black mud was collected 10 meters offshore in water 30 cm deep. Vegetation consists of mangrove trees.

Upon receipt, the water and dark brown butyl alcohol phases were decanted and saved. The mud was then placed in a large scale continuous liquid-solid extractor similar to that reported by Gibb (*1*). Extraction was conducted successively with 1:1 benzene-ethyl alcohol, ethyl alcohol, and chloroform until no further appreciable extract was removed as judged by the color of the solvent. The final extracts, including the butyl alcohol and supernatant sea water recovered before extraction, were mixed and evaporated to dryness under vacuum at room temperature using dry ice condensers. The residue, a very dark-brown malodorous solid, was ground with a mortar and pestle and stored under nitrogen. The yield, based on the extracted mud, which was dried at 120° C for 12 hr, was 2.5%.

Preliminary analysis of the extract has led to the isolation of free sulfur and NaCl. When an emission spectrum was analyzed, the material was found to contain calcium and magnesium as the major inorganic constituents. Present in small or trace quantities were strontium, potassium, silver, barium, nickel, copper, iron, chromium, manganese, titanium, silicon, and aluminum. No vanadium, an element commonly found in petroleum, could be identified by the spectrum.

When a small specimen of the extract was subjected to microsublimation using a Kofler-type microscope hot stage (*3*), it was possible to remove part of the sulfur only after decomposition of the residue. The organic material appeared to melt and char at approximately 100° C. Since this extremely unusual behavior warranted further investigation, the decomposition curve of 100 mg of the material was obtained by thermographic analysis (*5*). Sharp exothermic and endothermic decomposition peaks (curve 1 of Fig. 1) at 105°, 125°, 139°, and 150° C indicate the material to be extremely heat-sensitive at unusually low temperatures.

To investigate the products of decomposition, 1.0000 g of the total extract was sealed under vacuum in a 50-ml flask to which were attached an internal break-off tip and a mercury manometer. This bulb was placed in a constant temperature oven equipped with a fan to minimize the thermal gradient. On account of the thermographic curve and from geological thermal considerations, 150° C was chosen as a working temperature. The bulb was removed from the oven at intervals and the pressure of evolved gas was recorded at room temperature. The same experiment was repeated at 123° and at 98° C. Data for the three experiments are listed in Table 1.

In an effort to analyze the total original extract further, the material was Soxhlet-extracted with water to remove NaCl. It was found that NaCl alone was not removed in this fashion, but that 75% of the total extract was water-soluble. After drying under vacuum at room temperature, the water-soluble material was found to be light brown in color and to give an aqueous solution which fluoresced strongly under ultraviolet light. The residue from the water extraction was a black powder. Thermograms run on 100 mg of each of these products are shown in curves 2 and 3 of Fig. 1.

The thermogram of the water-insoluble fraction of the residue shows no sharply definable decomposition peaks

[1] This paper is a contribution from American Petroleum Institute Research Project 43 C located at the Massachusetts Institute of Technology. W. L. Whitehead, director; Clark Goodman, physical director.

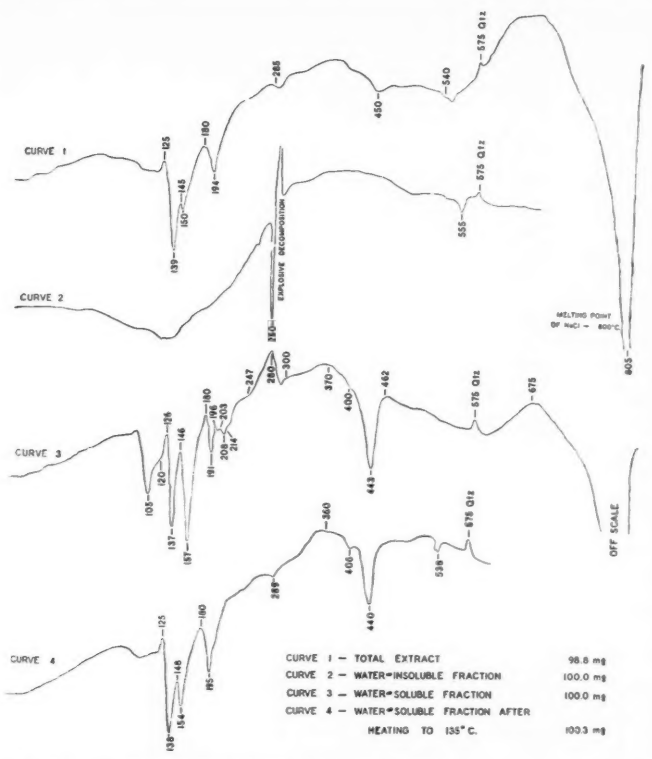
CURVE 1
CURVE 2
CURVE 3
CURVE 4
EXPLOSIVE DECOMPOSITION
MELTING POINT OF NaCl — 800°C.
OFF SCALE
CURVE 1 — TOTAL EXTRACT 98.6 mg
CURVE 2 — WATER-INSOLUBLE FRACTION 100.0 mg
CURVE 3 — WATER-SOLUBLE FRACTION 100.0 mg
CURVE 4 — WATER-SOLUBLE FRACTION AFTER HEATING TO 135°C. 100.3 mg

FIG. 1. Thermographic analyses of the total organic extract, water-soluble fraction, water-insoluble fraction, and water-soluble material after heat treatment at 135° C.

below 250° C. At this temperature the material decomposes with sufficient explosive power to blow the charge out and to blow off the cover of the sample block. The decomposition spectrum of the water-soluble fraction (curve 3 of Fig. 1) has a number of large, well-defined and completely reproducible peaks. These indicate that the portion of the total organic extract which is thermally unstable at low temperatures is concentrated in the water-soluble material of the extract.

Choosing 135° C as the working temperature from curve 3, 1.0000 g each of the water-soluble and water-insoluble fractions were thermally treated by the method described. Data for these experiments are shown in Table 1. Following thermal treatment, a thermogram was run on the water-soluble fraction and curve 4 of Fig. 1 was obtained. Loss of the 105° C peak is apparently caused by evaporation of water.

Examination of the samples of total organic extract indicates that heating at as low a temperature as 98° C converts them from a brown powder to a black, charred, tarry mass. The water-insoluble extract is converted to a black tar at 135° C, and the water-soluble fraction undergoes no change in physical appearance except for a slight degree of caking.

The gaseous products from each experiment listed in Table 1 were analyzed mass-spectrometrically.[2] The results are shown in Table 2.

It is especially significant to the studies of the origin of petroleum that the water-soluble fraction of the total organic extract yielded a complex mixture of gases composed of C_4, C_5, and C_6 hydrocarbons. These accounted for volumes up to 20% of the gas formed in the experiment. This mixture could not be analyzed because of the complexity of the peaks in the mass spectrum. Nevertheless, the relationship of the peaks indicates the hydrocarbons to be saturated, unsaturated, and cyclic in nature.

The water-insoluble fraction of the total extract is apparently the source of the hydrogen sulfide formed during the thermal degradations. Both the water-soluble and the water-insoluble fractions appear to contribute to the CO_2 produced. Of interest is the fact that pyrolysis produced no hydrogen. The usual hydrogen content of natural gas is below 1%, and some previous investigations on the origin of petroleum have led to the formation of considerable percentages of this age (*4*, *6*).

TABLE 1

THERMAL DECOMPOSITION OF EXTRACTS FROM CUBAN MUD

Sample No.	Description	Wt. g	Temp, °C	Time, hr	Gas formed, cc
1	Total extract	1.0000	148	46	10
2	Total extract	1.0000	123	28	2
3	Total extract	1.0000	98	72	1
4	Water-soluble fraction	1.0000	135	26	1
5	Water-insoluble fraction	1.0000	135	15	5

Although methyl chloride and ethyl chloride were unusual and unexpected products, both compounds have been reported in association with petroleum crudes (*2*). The mechanisms involved in this low temperature pyrolysis of marine organic matter to yield hydrocarbons are still unknown, but the complexity of the hydrocarbon mixture may possibly indicate free radical reactions. It

[2] This work was done through the courtesy of Dr. R. E. Honig of the Socony-Vacuum Research Laboratories. A Consolidated Engineering Company 180° spectrometer was used.

TABLE 2

GAS ANALYSIS FROM THERMAL DECOMPOSITION OF EXTRACTS FROM CUBAN MUD

Gas component	Sample No.: 1 Vol. % of total extract at 148° C	2 Vol. % of total extract at 123° C	3 Vol. % of total extract at 98° C	4 Vol. % of water-soluble fraction at 135° C	5 Vol. % of water-insoluble fraction at 135° C
H_2S	77.4	48.6	20.0	Trace	60.0
CO_2	14.3	27.6	29.7	29.2	10.0
H_2O	1.7	20.1	38.5	39.2	20.0
CS_2	—	—	0.7	—	—
CH_3Cl	—	—	—	3.3	—
C_2H_5Cl	—	—	—	6.3	—
Others	—	—	—	B*	—

* A—Several percent; B—C_4, C_5, C_6 hydrocarbons up to 20% of total volume of gas.

appears possible also that the water-soluble components of this mud may contain catalytic agents active in converting the material into hydrocarbons at 135° C or lower temperatures. Should this be found to be generally true in future studies, it may be possible to postulate the formation of petroleum after its migration through geological barriers impervious to hydrocarbons. The hydrocarbon-forming substances and the catalysts may have migrated together in aqueous solution and the genesis of the petroleum may even have taken place in the reservoir.

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Comparison of Peripheral Blood with Heart Blood in Guinea Pigs

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Interest has been shown recently in the differences existing in the peripheral blood as compared to blood drawn from the heart (*1, 2*). The experiments reported here present further data on these differences.

Comparisons of peripheral and heart blood counts were made in our laboratory on 56 normal guinea pigs. Blood for the peripheral counts was obtained from the ear in the following manner: A nick was carefully made in the ear of each guinea pig in order to sever the marginal vein. The first blood was wiped off and blood counts were taken from the freely flowing wound. The guinea pigs were then given nembutal, as they were being sacrificed for another experiment, and heart blood was drawn by syringe directly from the heart without opening the body cavity. In those instances in which there was the slightest indication of clotting, no counts were made.

Peripheral white cell counts ranged from 5,250 to 11,700, with an average count of 7,558 cells per cu mm. White cell counts on heart blood ranged from 3,850 to 10,350, with an average white count of 5,763 cells per cu mm, about 74% of the average peripheral white count.

Peripheral red cell counts ranged from 4,070,000 to 8,080,000, with an average red cell count of 6,269,000 cells per cu mm. Heart-drawn counts ranged from 3,030,000 to 6,740,000, with an average of 5,499,000 cells per cu mm, or about 88% of the average peripheral red cell count.

Differential white cell counts seemed to show no conclusive differences.

Table 1 presents a statistical summary of our findings. The usual statistical formulas were employed in the determinations of these data.

The peripheral blood has a significantly greater number of both red and white cells.

TABLE 1

	Average and probable error	Coefficient of variation and probable error	Significant ratio*
Red cells in millions			
Peripheral	6.269 ± 0.064	10.44 ± 0.72	8.31
Heart	5.499 ± 0.067	12.50 ± 0.87	
White cells in thousands			
Peripheral	7.558 ± 0.169	22.19 ± 1.65	8.06
Heart	5.763 ± 0.145	25.03 ± 1.89	
Lymphocytes (%)			
Heart	73.22 ± 1.05	15.09 ± 1.03	1.55
Peripheral	70.79 ± 1.16	17.88 ± 1.18	
Polymorphs (%)			
Heart blood	23.88 ± 1.00	44.04 ± 3.25	0.14
Peripheral blood	23.68 ± 1.01	46.52 ± 3.33	

* The difference divided by its error.

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Comments and Communications

A Simple Microfilm Reader and the Microfilm Process

As an aid in research the use of microfilm copies of inaccessible references is steadily increasing. A serious drawback to the more extended use of microfilming has been the expense and unsatisfactory performance of the reading equipment. The usual form of reader is a cumbersome camera obscura, where the film is projected on a reading screen. For those lacking a reading machine, enlarged prints from microfilm can be bought, but they cost more.

A simple, inexpensive, and practical reader is available in the common box-type substage lamp used with a low power microscope. A piece of glass the size of the top, fastened at the ends with adhesive tape and raised so as just to permit the film to slide through, will hold the film steadily in focus. A magnification of about 10 × affords a visual impression slightly smaller than the printed original, and with wide-field oculars will accommodate a page at a time. With the substage viewer, perfect processing of the film is not important, because underexposed or overdeveloped films are still legible. The viewer may be used for perforated or nonperforated film as well as for 16-mm strips, which is not the case with some commercial readers.

Library equipment for microfilming is elaborate and expensive. For personal use a 35-mm camera has proved satisfactory when provided with a supplementary lens to shorten the focus and with a focusing attachment for centering the field.

It has been expertly estimated that more than 25 billion records have been microfilmed during the twenty years that this process has been used. Most of these microfilms have been utilized in industry, where the saving of space is important in keeping records. But it is obvious that hundreds of thousands of pages of copyrighted material have been photographed for the use of research workers, a technical infringement of the copyright law, which explicitly provides that the owner of a copyright "shall have the exclusive right: to print, reprint, publish, copy and vend the copyrighted work" in whole or in any part. The fact that the copying is for research and not profit does not enter into the statute.

While microfilming excerpts of a copyrighted article may constitute a technical legal infringement, it is now so universally done that courts would be reluctant to impose penalties on individual scientists who in good faith are dependent on the process. It is the custom of libraries not to sell but only to lend the microfilm, though for an indeterminate period, the charge being only for the service and based on actual cost to the institution. Libraries also require a release from the applicant, who must assume full responsibility for possible misuse of the copyright. While these restrictions may seem formidable, it is generally conceded that research workers may rely with safety on a "fair-dealing" agreement, constituted in 1935 and confirmed in 1946, between a committee on research and representatives of book publishers. In effect, this agreement approves microfilming extracts of copyrighted scientific works for research purposes. Heretofore, there has been no legal interference with copying by hand for scholarly use, and photoduplication is now regarded as a modern timesaving substitute.

A useful directory of microfilm services in the United States and Canada is available from the Special Libraries Association, 31 East 10th Street, New York City, which lists institutions, commercial firms, costs, stipulations and conditions concerning this important process.

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The Mechanism of Ionization in Solution

According to L. Pauling's calculations from data on bond energies (*The Nature of the Chemical Bond*, Ithaca, New York: Cornell Univ. Press, 1941), the relative ionic contributions in the series III, IIBr, IICl, and IIF amount to 5%, 11%, 17%, and 60% respectively, despite the fact that the first three in aqueous solutions are strong acids. He emphasized the fact that "the amount of ionic character of a bond in a molecule must not be confused with the tendency of the molecule to ionize in a suitable solvent." The mechanism of ionization in solution is not simple because transformation of bond type, deformation of structure, and solvation are all involved. The purpose of this note is to summarize current ideas in order to form a preliminary general picture of the process of ionization. When the hydrogen halides HI, HBr, and HCl are brought into solution from the gas phase, their covalent contributions decrease and seem to disappear in water, which possesses the same leveling effect on each of these acids. It would therefore be of interest to know the extent to which their ionic contributions increase in other solvents. This procedure may reveal the transition from the covalent to the ionic binding.

F. Fairbrother (*Trans. Faraday Soc.*, 1932, **30**, 862) suggested that measurements of the dipole moments of hydrogen halides in nonpolar solvents would yield some information on change in bond type. His measurements, as well as those of Mizuschima (Mizuschima, S., Suenaga, K., and Kojima, K. *Bull. chem. Soc. Japan.*, 1935, **10**, 167), show moments which are distinctly higher than those obtained in the gas phase. Table 1 summarizes these results. From their data the amount of relative ionic character of the H-X bond in solution is estimated in the last column as the ratio of the dipole moment measured in solution to the product of charge and interatomic distance. F. C. Frank (*Proc. roy. Soc.*, 1935, **A152**, 171) explained Fairbrother's data on the basis of a large moment induced on solution. Further evidence is obtained from the work of Ulich (Ulich, H., Hertel, E., and Nespital, W. *Z. phys. Chem.*, 1932, **B17**, 21), who studied the deformation of inorganic halides in solution

TABLE 1

CALCULATION OF IONIC CONTRIBUTION IN SOLUTION

HX	Solvent	μ* Gas	μ* Solution	μ* Solution/ex†
HCl	C_6H_6	1.03	1.22	0.20
	CCl_4		1.32	0.217
	$c-C_6H_{12}$		1.32	0.217
	$n-C_6H_{14}$		1.04	0.17
	$CH_3 \cdot C_6H_5$		1.24	0.204
	$CHCl_3$		1.03	0.17
	$(C_2H_5)_2O$		2.22	0.365
HBr	C_6H_6	0.79	1.01	0.15
	CCl_4		.96	0.143
HI	C_6H_6	0.38	.58	0.076
	CCl_4		.50	0.065

* μ = Dipole moment.
† e = Electronic charge; x = distance of separation of atom.

by dipole moment measurements. They showed that the symmetry of stannic chloride is changed by attachment to a polar molecule such as ether or acetone, from a regular tetrahedron with no dipole moment to a pyramid with a moment of 2.46 D (Debye units—1D = 10^{-18} electrostatic units). The measurements of these authors showed that metal halides suffer not only deformation by association with polar molecules, but also with nonpolar molecules such as hydrocarbons. Thus, aluminum chloride in solution undergoes a certain deformation which might lead to false conclusions in the case of anisotropic hydrocarbons. Aluminum bromide in benzene has a moment of 5.5 D and zero moment in carbon disulphide. The measurements show that angular deformation takes place by the attachment of other molecules, resulting in an increase in dipole moment.

G. Briegleb and W. Lauppe (*Z. phys. Chem.*, 1935, **B28**, 154) proposed that acetone deforms the beryllium chloride molecule by changing the valence spring force, producing a distorted molecule with a moment of 5.7 D. They also obtained evidence for this symmetry deformation by measuring the shift of the Raman lines when stannic chloride was dissolved in alcohol. Six lines, characteristic of a triangular pyramid, appeared. Aluminum chloride shows similar behavior.

This picture of deformation of inorganic halides finds application in visualizing the mechanism of Friedel-Craft's reaction. Aromatic hydrocarbons (ArH) may be alkylated by means of mixed ethers R_1OR_2. The relative amounts of ArR_1 or ArR_2 in the product will depend largely upon the mechanism of the interaction of aluminum chloride with the ether used. The separation of either R_1^+ or R_2^+ from the coordination complex will depend on the extent of the deformation in the C-O-C angle by the attachment of aluminum chloride to the lone pair of electrons on the oxygen atom. The more positively charged the alkyl group, the greater its tendency to separate as an ion. Considerable infrared (Williams, D., *Phys. Rev.*, 1936, 50, 719) and Raman spectroscopic work (West, W. and Arthur, P. *J. chem. Phys.*, 1937, 5, 10) on solutions of hydrogen halides show that their vibration characteristics change when the halides form hydrogen bonds with oxygenated solvents. Gross and co-workers (Weith, A. M., Hobbs, M. E., and Gross, P. M. *J. Amer. chem. Soc.*, 1948, 70, 805) find that hydrogen chloride in dioxane exhibits absorption bands in a region which can be ascribed to the perturbed hydrogen chloride molecule. This result indicates that the solute has not gone over into an ion pair in dioxane.

From the calculations of Table 1 and the optical evidence obtained for hydrogen halides in solution, it becomes apparent that an increase in the amount of ionic character of the bond is accompanied by a shift in the absorption bands. This leads to the suggestion that in solution the nuclei are vibrating over an equilibrium distance which is greater than that of the gaseous molecule. As the dielectric constant of the solvent increases, the ionic character of the bond increases and a high dipole moment should be observed. This results in a deformation of the molecule, the nuclei of which will vibrate over a greater equilibrium distance. An increase in the vibrational energy should require a decrease in the potential energy, and the latter goes to a minimum when the former goes to a maximum. Beyond this limit, a new potential energy of the system $H^+ X^-$ is required. A deformation in the H-Cl bond has been reported by P. D. Bartlett and H. J. Dauben, Jr. (*J. Amer. chem. Soc.*, 1940, 62, 1339) and is accompanied by an increase in the acid strength of hydrogen chloride due to hydrogen bond formation with phenols in dioxane as a solvent. The HCl-phenol complex can be looked upon as similar to the beryllium chloride-acetone complex.

Very recently C. G. Swain and R. W. Eddy (*J. Amer. chem. Soc.*, 1948, 70, 2989) investigated termolecular displacement reactions of methyl halides in benzene solution. Methyl bromide was allowed to react with pyridine in benzene solution at 100° C. They found that added methanol, phenol, or mercuric chloride facilitates the reaction, apparently by solvating the bromine atom of methyl bromide in front, while pyridine simultaneously attacks from the back. Their push-pull mechanism finds a simple explanation in the light of deformation theory. The amount of ionic character of the C-Br bond in methyl bromide would be expected to increase in the presence of benzene or alcohol, due to the deformation occurring in the tetrahedral structure. This deformation would be accompanied by a larger dipole moment, which results in the formation of a more positively charged carbon atom. Pyridine then would attack readily with its lone pair of electrons on the more positively charged carbon atom. Aluminum bromide, which is deformed in benzene and acquires a dipole moment of 5.5 D, has been reported by these authors to accelerate the reaction by 20% ± 8% in a .045 M solution.

The above examples suggest that solvation by one of several mechanisms occurs in general on solution of a polar substance, leading to a change in the relative ionic character of the bond with respect to the state of the gas molecule. The ionizing tendency of the solute is in turn determined by the ionic character of the resulting complex.

HUSSEIN SADEK

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Association Affairs

Gordon Research Conferences June 26–September 1, 1950

W. George Parks
Rhode Island State College, Kingston

The Gordon Research Conferences, sponsored by the AAAS, formerly known as the Gibson Island Research Conferences, for 1950, will be held June 26–September 1 at the Colby Junior College, New London, New Hampshire, and the New Hampton School, New Hampton, New Hampshire, both within 100 miles of Boston.

The conferences were established to stimulate research in universities, research foundations, and industrial laboratories. This purpose is achieved by an informal type of meeting consisting of the scheduled lectures and free discussion groups. Meetings are held in the morning and in the evening, Monday through Friday, with the exception of Friday evening. The afternoons are free for recreation or participation in discussion groups. This type of meeting is a valuable means of disseminating information and ideas which otherwise would not be realized through the normal channels of publication and scientific meetings. In addition, scientists in related fields become acquainted and valuable associations formed which have resulted in collaboration and cooperative efforts between different laboratories.

It is hoped that each conference will extend the frontiers of science by fostering a free and informal exchange of ideas. The purpose of the program is not to review the known fields of chemistry, but primarily to bring experts up to date as to the latest developments, analyze the significance of these developments, and to provoke suggestions as to the underlying theories and profitable methods of approach for making new progress. In order to protect individual rights and to promote discussion, it is an established requirement of each conference that all information presented is not to be used without specific authorization of the individual making the contribution, whether in formal presentation or in discussion. Scientific publications are not prepared as emanating from the conferences.

Registration and Reservations

Individuals interested in attending the conferences are requested to send in their applications to the director, on or before April 20. Each applicant must state the institution or company with which he is associated and the type of work in which he is most interested. Attendance at each conference is limited to 100.

The director will submit the names of those requesting attendance to the conference committee for each conference. This committee will review the names and select the members in an effort to distribute the requests as widely as possible among the various institutions and laboratories represented. The names selected will be returned by the conference committee to the director, who will notify those accepted as soon as possible. A registration card will be mailed with the notice of selection. Advance registration by mail for each conference is required. On receipt of the completed registration card and a deposit of $25.00 made payable to the Gordon Research Conferences, AAAS, registration will be completed. The deposit of $25.00 will cover the registration fee of $15.00 (except for academic individuals and students on personal expense who may apply for a reduction of $5.00), the balance to be credited against subsistence expenses at the conference. The room rates have been established as follows: $2.50 per night per person in a double room with single beds; $3.00 per night per person in a single room, $3.50 per night per person in a single or double room with private bath. Meals served in the dining room will be charged at the rate of $5.75 per day per person. An effort will be made to reduce these rates if warranted by economic conditions. Ten percent is added to each bill to provide for all gratuities. Members attending a conference are expected to live at the conference. If special circumstanes warrant living elsewhere, a charge of $1.00 per day will be made to assist with the financial support of the conferences. The special reduction of 75 cents per day to members attending a conference at personal expense has been discontinued by the Management Committee.

The Management Committee has made available to each of the 1950 conferences a limited fund which may be used to contribute toward the expenses of academic or government employees, either as speakers or participants in the conferences. This fund will be provided from the registration fees collected, and is to be used only to assist academic or government employees who otherwise are not able to attend, and whom the conference chairman or program committee believes should be invited to be present, in the expectation that they will make significant contributions to the program. The chairman of the conference and the director of the conferences are charged with the responsibility for the disbursement of this fund. It may be used to contribute toward the traveling expenses or subsistence expenses at the Conference. The money is to be used as an assistance fund only. Total travel and subsistence expenses normally will not be available. It is expected that an individual receiving assistance from this fund will attend the Conference and be available for participation in the discussions during the four and one-half days of the conference.

If it is necessary to cancel a reservation, the notice must be received in the office of the director three weeks prior to the conference. If such notice is received three weeks

in advance of the conference, $20.00 will be refunded from the $25.00 deposit. No refund will be made for cancellations received within the three-week period.

The first meeting of each conference is held Monday morning at 9:00 o'clock EDST. The morning sessions, through Friday, are scheduled from 9:00 a.m. to 12:00 noon. The second session of each day is held in the evening from 7:30 to 10:00 p.m., Monday through Thursday. There are no Friday evening meetings.

Public lectures, sponsored jointly by the school and the Gordon Research Conferences, will be organized on Sunday evenings preceding each conference. The schedule of these lectures has not been completed. The tentative dates on which it is hoped to have available an outstanding speaker on a subject of general interest are stated in the program.

Accommodations are available for a limited number of women to attend each conference, also for wives who wish to accompany their husbands. All such requests should be made at the time of the request for attendance, because these limited accommodations will be assigned in the order that specific requests are received.

Requests for attendance at the conferences or for any additional information should be addressed to W. George Parks, Director, Department of Chemistry, Rhode Island State College, Kingston, Rhode Island. From June 20–September 1, mail should be addressed to Colby Junior College, New London, New Hampshire.

Program at

Colby Junior College, New London, New Hampshire

C. W. Montgomery, Chairman; A. Farkas, Vice Chairman

June 26–30 Detailed program will be announced and distributed as soon as it is completed. The topics to be discussed are as follows: "Thermodynamics of Absorption"; "Electronic Structure of Catalysts"; "Examination of Catalysts by Physical Methods"; "Mechanism Studies on Fischer-Tropsch Oxo Aromonatization and Catalytic Cracking"; "A General Review of Oxidation Catalysis."

July 2 8:00 p.m., public lecture. Speaker and subject to be announced.

Petroleum

C. C. Price, Chairman; Robert W. Schiessler, Vice Chairman

July 3 K. E. Stanfield, "Composition and Structure of Oil Shales"; W. I. R. Murphy, "Compositions and Structure of Shale Oils."

July 4 A. H. Batchelder, "Fundamental Information on Composition and Structure of Greases"; E. C. Hughes, H. F. Hardman, and R. B. Faris, Jr., "Some Fundamental Studies on the Composition and Physical Properties of Asphalt."

July 5 R. F. Marschner, "Urea Adduction"; A. N. Sachanen, "Synthetic Lubricants by Olefin Polymerization."

July 6 H. C. Brown, "The Nature of Aluminum Chloride Complexes"; A. W. Francis, "Ternary Diagrams as Applied to Solvent Extraction."

July 7 O. Beeck, "Isomerization and Related Reactions of Isotopic Hydrocarbons."

July 9 8:00 p.m., public lecture. Prof. Charles H. Smiley, Brown University, "The Arctic."

Polymers

H. M. Spurlin, Chairman; Turner Alfrey, Jr., Vice Chairman

July 10 Herman Mark, "Survey of Advances During the Last Year"; H. A. Bruson, "Reactivity of Some Diene Polymer Systems Toward Hydrogen Donors."

July 11 Carl E. Black, "The Structure and Properties of Condensation Co-polymers"; Emmette F. Izard, "The Effect of Chemical Composition on Selected Physical Properties of Linear Polymers"; Clayton Huggett, "Effect of Traces of Metals on Homogenous Free Radical Polymerization."

July 12 P. J. Flory, T. G. Fox, A. V. Tobolsky, Turner Alfrey, Jr; Symposium on Hardening of Polymers at Low Temperature.

July 13 Peter Debye, F. T. Wall, "Polymer Electrolytes"; R. M. Fuoss, "Polymer Electrolytes" (continued); John R. Caldwell, "New Classes of Solvents for Proteins and Polyamides."

July 14 E. R. Purchase, R. W. Nebel, "The Acetylation of Cellulose"; L. A. Hiller, Jr., "The Kinetics and Thermodynamics of Cellulose Acetylation."

Textiles

Earl E. Berkley, Chairman; Joseph H. Brant, Vice Chairman

July 17 B. B. Robinson, "Production and Utilization Problems of Long Vegetable Fibers"; J. B. Goldberg, "The Interpretation and Practical Application of Textile Research."

July 18 W. J. Hamburger, "New Scientific and Psychological Methods Applied to the Evaluation of Complex Textile Properties"; Games Slayter, "New Developments in Glass Fibers and Their Fields of Industrial Application."

July 19 J. A. Howsmon, "The Fine Structure of Cellulose Fibers"; Robert F. Peterson, "Methods of Preparing Casein Fibers and Their Properties."

July 20 H. J. White, Jr., "Some Physical Chemical Studies on Dyeing"; G. R. Seidel, "Flame Retarding Cellulosic Materials with Salts of Titanium and Antimony."

July 21 B. L. Browning, "Influence of Fiber Characteristics on Paper Making Properties."

July 23 8:00 p.m., public lecture. Subject and speaker to be announced.

Corrosion

Norman Hackerman, Chairman; F. W. Fink, Vice Chairman

July 24 H. H. Uhlig, "Contact Potentials"; D. MacGillavry, Jr., "Metal-Solution Interface Potentials."

July 25 W. D. Robertson, "Double Layer Capacity at an Electrode"; A. J. deBéthune, "Overvoltage."

July 26 Speaker to be announced, "Polarization"; F. L. LaQue, "Polarization in Flowing Solutions."

July 27 H. D. Holler, "Potentials of Galvanic Couples"; K. G. Compton, "Potentials of Coated and Inhibited Metals."

July 28 J. M. Pearson, "Summation: The Working Electrode in Corrosion Processes."

INSTRUMENTATION

V. F. Hanson, Chairman; H. W. Washburn, Vice Chairman

July 31 Van Zandt Williams, "Recent Developments in Infrared Spectrometry"; Howard Cary, "Instrumentation for Ultra Violet Spectrophotometry"; N. B. Hannay, "The Application of the Mass Spectrometer to Analytical Problems Encountered in the Development of Electronic Equipment"; M. J. O'Neal, "High Molecular Weight Mass Spectrometry."

August 1 R. J. Moon, "A Means of Amplifying and Intensifying the Fluoroscopic Image by Means of a Scanning X-Ray Tube"; L. O. Brockway, "Electron Diffraction Instrumentation and Its Application to the Analysis of Solids"; Eric T. Clarke, "Application of Radioactive Isotopes in Industry and the Instruments Required for Their Application"; S. E. Eaton, "The Use of Radioactive Materials for Making Measurements."

August 2 Speaker to be announced, "Instrumentation and Applications of Microspectroscopy"; Leo L. Helterline, Jr., H. V. Hjermstad, Symposium on A.C. Voltage Regulators. Symposium on Special Instruments, I.

August 3 Russell H. Varian, "Industrial Applications of Nuclear Induction"; Speaker to be announced, "Radiofrequency Measurement of Conductivity of Electrolytes Without Electrodes"; Symposium on Special Instruments, II.

August 4 Earl H. Wood, "Special Instrumentation Problems Encountered in Physiological Research Concerning the Heart and Circulation."

August 6 8:00 p.m., public lecture. Speaker and subject to be announced.

VITAMINS AND METABOLISM

E. L. R. Stokstad, Chairman; W. J. Darby, Vice Chairman

August 7 L. Reiner, "Role of Methionine in the Toxicity of Nitrogen Trichloride Treated Protein"; E. C. Reifenstein, "Disturbances of Calcium Metabolism in Clinical Medicine"; B. Connor Johnson, "Synthetic Milk Feeding of New Born Pigs and Calves with Particular Reference to Vitamin B_{12}"; T. J. Cunha, "Animal Protein Factor, Vitamin B_{12}, and Related Factors for the Pig."

August 8 V. Petrow, "Chemistry of Vitamin B_{12}"; T. H. Jukes and K. C. Burke, "Role of Vitamin B_{12} in Transmethylation"; Gladys Emerson, discussion; F. R. Bethell, "The Relationship of Vitamin B_{12} to Intrinsic Factor of Castle"; J. R. Couch, "Vitamin B_{12} Studies in the Avian Species"; E. L. R. Stokstad, "The Multiple Nature of the Animal Protein Factor."

August 9 William Shive, "The Folinic Acid Group"; H. P. Broquist, discussion; P. L. Day, "Studies on the Metabolic Function of Pteroylglutamic Acid"; K. Schwarz, "Dietary Liver Degeneration and Liver Protecting Compounds."

August 10 Aaron Bendich, "Metabolism and Pharmacology of the Purines"; H. Borsook, "The Incorporation of Labeled Amino Acids into Tissue Proteins *In Vivo* and *In Vitro*"; D. R. Lincicome, "Some Aspects of Helminth Metabolism."

August 11 A. F. Bliss, "Role of Vitamin A in the Visual Cycle"; Norris D. Embree, Stanley R. Ames, Robert W. Lehman, and Philip L. Harris, "Vitamin A—The New Official Standard, Methods of Determination and Biopotency of Various Forms."

FOOD AND NUTRITION

James B. Allison, Chairman; Bernard L. Oser, Vice Chairman

August 14 Intravenous Alimentation. Robert A. Harte, discussion, Introductory Remarks; Frederick J. Stare, "Intravenous Fat Alimentation"; Robert Elman, "Intravenous Inorganic Alimentation"; John J. McGraw, "Intravenous Globin Alimentation." *Purine and Pyrimidine Metabolism.* John M. Buchanan, Discussion, "In Vivo and In Vitro Studies on Biosynthesis of Purine and Pyrimidine Bases"; William Shive, "Some Functions of B Vitamins in the Biosynthesis and Metabolism of Purines and Pyrimidines"; Paul M. Roll, "Formation of Nucleic Acids from Purine and Pyrimidine Bases or Nucleosides in Yeast and Animal Tissues."

August 15 Effects of Environmental Stress on Nutrition. Harry Spector, Discussion, Introductory Remarks; Robert E. Johnson, "The Effects of Cold Stress on Metabolism in Man"; D. M. Hegsted, "Animal Experimentation and Cold Environment." *Newer Factors in Nutrition.* Bacon F. Chow, discussion, introductory remarks; B. H. Ershoff, "On the Presence of an Antithyrotoxic Factor in Animal Tissues Distinct from Any of the Known Nutrients"; Gladys Emerson, "Vitamin B_{12}."

August 16 The Chemistry and Physiology of Post Harvest Metabolism in Fresh Fruits and Vegetables. Walter A. Maclinn, discussion, introductory remarks; W. T. Pentzer, "Methods for Retarding the Rate of Metabolism in Fresh Fruits and Vegetables after Harvesting"; J. R. Magness, "Post Harvest Chemistry and Physiology of Certain Fresh Fruits and Vegetables." *Food Technology of Beverages.* Speaker to be announced, Discussion, Introductory Remarks; Thomas Rector, "Recent Advances in Coffee Technology"; George S. Mitchell, "Technological Problems in Production and Handling of Tea."

August 17 Nutrition of Infants and Children. Anthony A. Albanese, Discussion, "Protein and Amino Acid Requirements of Infants and Young Children";

Genevieve Stearns, "Factors Affecting the Mineral Requirements of Children"; Victor A. Najjar, "Recent Developments." *Nutrition in Disease.* Olaf Mickelsen, discussion, introductory remarks; Seymour H. Rinzler, "Nutrition and Cardiovascular Disease"; George Gabuzda, "Nutrition in Liver Disease."

August 18 Criteria for Safety of Foods. Bernard L. Oser, discussion, introductory remarks; A. J. Lehman, "The Viewpoint of the Government"; J. P. Kass, "The Viewpoint of Industry."

August 20 8:00 p.m., public lecture. Speaker and subject to be announced.

MEDICINAL CHEMISTRY

Marlin T. Leffler, Chairman; Otto K. Behrens, Vice Chairman

August 21 Hormones. DeWitt Stetten, Jr., "The Hormonal Regulation of Certain Metabolic Processes"; Dwight J. Ingle, "Effect of Adrenal Hormones on Metabolism"; Edwin E. Hays, "Chemistry of ACTH"; Lewis H. Sarett, "Synthesis of Adrenal Steroids."

August 22 Hormones (continued). Peter H. Forsham, "Clinical Effects of Adrenal Hormones"; John R. Mote, "The Role of the Adrenal Gland in Human Diseases." *Antigastric Secretory Agents.* Charles F. Code, "The Qualitative Determination of Antigastric Secretory Activity with Comments on the Physiologic Basis of Such Activity and Its Occurrence in Some Agents"; Joseph B. Kirsner, "Present Clinical Status of Antigastric Secretory Agents."

August 23 Protein Binding. I. M. Klotz, "The Nature of Some Protein Complexes"; Walter L. Hughes, Jr., "Protein-Small Molecule Interactions" (tentative subject); Britton Chance, "Binding of Substrates and Prosthetic Groups in Hemoproteins"; S. H. Armstrong, Jr., "The Physiological Significance of Protein Binding."

August 24 Nucleic Acids. Hubert S. Loring, "Chemistry of Nucleic Acids"; George B. Brown, "Nucleic Acid Metabolism"; Hans Popper, "Nucleic Acids in Pathology." Metabolism of Drugs, Bernard B. Brodie, "Chemotherapeutic Implications of Studies of the Fate of Drugs in Man"; E. W. Maynert, "Metabolism and Elimination of Barbiturates."

August 25 Antithyroid Substances. R. G. Jones, "Chemistry and Metabolism of Antithyroid Substances"; E. B. Astwood, "Antithyroid Substances, Methods of Testing and Clinical Results."

CANCER

W. U. Gardner, Chairman; M. J. Shear, Vice Chairman

August 28 George W. Kidder, "Some Aspects of Comparative Biochemistry of Purines and Pyrimidines"; Alfred Gellhorn, "Experimental Cancer Chemotherapy with Purine and Pyrimidine Derivatives"; Dietrich Bodenstein, "Studies of Growth and Differentiation on Embryonic Cells"; L. C. Strong, "Litter Seriation in Cancer Susceptibility."

August 29 E. V. Jensen and C. Huggins, "Serum Proteins in Cancer"; Stuart W. Lippincott, Helen Thornton, Lester D. Ellerbrook, Marsh C. Rhees, C. T. O. Fong, and E. C. Stowell, Jr., "Complement Fixation in Animal Neoplasia. A Study of the Factors Involved in the Reaction with the Brown-Pearce Carcinoma"; Freddy Homburger, "Evaluation of Diagnostic Tests for Cancer"; J. K. Cline, "Systematic Study of Some Proposed Cancer Tests."

August 30 James A. Reyniers, "Germ Free Life and the Cancer Problem"; W. F. Dunning, "Dietary Deficiencies and Excesses in the Economy of Cancer"; Julius White and M. Berenbom, "Some Metabolic Studies of Normal and Tumor Bearing Animals with N^{15}"; Paul C. Zamecnik, Ivan D. Frantz, Jr., and Robert B. Loftfield, "Labelled Amino Acids in the Study of Normal and Abnormal Growth."

August 31 W. E. Smith and D. A. Sunderland, "Experimental Studies with Carcinogenic Materials from the Petroleum Industry"; Kenneth M. Lynch, "Asbestos and Cancer of the Lung"; (speaker and subject to be announced); F. Duran-Reynals, "Environment and Virus Variations."

September 1 R. W. Rawson, "What Radio-Iodine Has Taught Us About the Pathologic Physiology of Thyroid Neoplasms"; A. Haddow, "Nitrogen Mustard Carcinogens and Their Site of Action."

Program at *New Hampton School, New Hampton, New Hampshire*

CHEMISTRY AND PHYSICS OF METALS

Earl A. Gulbransen, Chairman

July 3 The Metallic Bond. S. Dushman, "Atom Bonds in Metals"; speaker to be announced, "Solid State Theory and Metallic Binding"; D. Harker, "Some Theories of Intermetallic Chemistry."

July 4 D. P. Shoemaker, "The Crystal Structure of Some Intermetallic Compounds"; L. Brewer, "Bonding in Semi-metals"; R. E. Rundle, "Bonding in Interstitial Compounds."

July 5 C. Wagner, "The Relationship Between Measurable Thermodynamic Properties and Theories of the Solid State"; E. Wallace, "Experimental Methods for Evaluating Cohesive Energies, Free Energies, and Residual Entropies of Simple Alloys as Illustrated by the Mg-Cd. System"; D. P. Smith—presented by G. Derge, "The Distribution and State of Hydrogen in Metals and Certain Inferences"; C. G. Shull, "Neutron Diffraction Studies in Relation to Solid Structure."

July 6 H. B. Huntington, "Metallic Binding Near Surfaces and Lattice Defects"; speaker to be announced, "Relationships Between Elastic Constants and the Effect of Pressure and Metallic Binding"; C. H. Shaw, "A Survey of X-Ray Studies on the Electronic Band Structure of Metals."

July 7 R. Speiser and J. W. Spretnak, "Theoretical Predictions of Binary Phase Diagrams."

CURRENT TRENDS IN ANALYTICAL CHEMISTRY

B. L. Clarke, Chairman; W. E. Campbell, Vice Chairman

July 10 N. H. Furman, "Introductory Survey"; R. H. Müller, "A Topic in Instrumental Analysis."

July 11 H. S. Strain, "Analysis by Chromatographic Adsorption"; Charles E. White, "Fluorescence Analysis."

July 12 Grant Wernimont, "Statistical Methods in Analysis"; W. J. Youden, "Statistical Methods in Analysis."

July 13 J. J. Lingane, "Electrical Methods in Analysis"; W. E. Campbell, "Electrical Methods in Analysis."

July 14 C. W. Gould, "Organic Analysis."

ORGANIC COATINGS

G. W. Seagren, Chairman

Mechanism of Film Formation

July 17 *Mechanism of Film Formation.* W. O. Lundberg, "The Role and Mechanism of Oxidation in the Film Formation of Drying Oils"; D. H. Wheeler, "Heat-Induced Polymerization."

July 18 A. K. Doolittle, "Mechanism of Solvent Action and Film Formation"; J. Kenneth Craver, "Mechanism of Plasticization."

July 19 Daniel Smith, "Rheology in Film Formation"; R. H. Kienle, "Factors in the Formation and Behavior of Pigmented Films."

July 20 Speaker to be announced, "Reenforcement of Films by Pigments"; W. K. Asbeck, "Electrokinetic Properties of Pigment Dispersions."

July 21 H. F. Payne, "Mechanism of Water Absorption and Diffusion."

ION EXCHANGE

Robert Kunin, Chairman; F. C. Nachod, Vice Chairman

July 24 George Boyd, Harry Gregor, "Basic Physical Chemistry of Ion Exchangers"; Walter Juda, K. Sollner, "Membrane Electrodes."

July 25 E. Glueckhauf, K. Kraus, "Ion Exchange Separations in Inorganic Chemistry"; S. Moore, A. Reid, "Ion Exchange Separations in Organic Chemistry."

July 26 G. Bodamer, "Ion Exchange in Non-Aqueous Media"; L. Hammett, F. Nachod, "Catalytic Properties of Ion Exchange Substances."

July 27 W. Rieman, "Ion Exchange in Analytical Chemistry"; H. Thomas, subject to be announced; W. Bauman, R. Kunin, and others, "Evaluation Methods and Characterization of Ion Exchange Substances."

July 28 E. Roberts, G. Monet, "Fundamental Engineering Principles of Ion Exchange."

MICROBIOLOGICAL DETERIORATION

John Leutritz, Jr., Chairman

July 31 R. H. Colley, "General and Historical Review, Chemistry of Cellulose and Related Substances, Organisms Causing Deterioration and the Mechanism of Destruction, Ecology of Bioagents, Enzyme Action."

August 1 R. H. Baechler, "Relation Between Chemical Structure and Fungicidal Activity, Mechanism of Preservation, Effect of Chemical Compounds on the Metabolism of Organisms."

August 2 G. A. Garratt, J. F. Oesterling, "Chemical Relationships Between the Cellulosic Substrate and the Preservative, Methods of Employing the Preservative, Effect of Environment on Efficacy of the Preservative, Processing Factors as Limitations."

August 3 G. A. Greathouse, "Evaluation of Preservatives; Screening, Accelerated and Service Tests. Other Factors Toxicity, Corrosion, Odor, etc."

August 4 J. Leutritz, Jr., "Practicability of Preservatives." Round table discussion. Each moderator will be supported by short papers and prepared discussions in addition to the general discussion from the floor.

PHYSICAL METHODS IN NUCLEIC ACID AND PROTEIN RESEARCH

Kurt G. Stern and Elkan R. Blout, Cochairman

August 28 *Electron Microscopy.* C. E. Hall, "Electron Microscopy of Protein Molecules" (tentative). *X-Ray Diffraction.* I. Fankuchen, "X-Ray Diffraction Studies on Proteins, Enzymes, and Viruses"; W. T. Astbury, "X-Ray Diffraction Studies on Proteins and Nucleic Acids."

August 29 *The Action of Ultraviolet Light, Ultraviolet Spectroscopy and Ultraviolet Microspectroscopy.* A. D. McLaren, "Photochemical Studies on Proteins, Enzymes, and Viruses"; A. Pollister, "Photometric Studies on Intracellular Nucleic Acids."

August 30 *Infrared Spectroscopy and Microspectroscopy.* R. S. Halford, "Polarized Infrared Spectroscopy of Proteins"; E. R. Blout, "Infrared Spectroscopy and Microspectroscopy of Nucleic Acids and Their Components."

August 31 *Molecular Size and Shape.* P. Doty, "Light Scattering and Its Applications to Nucleic Acids"; J. L. Oncley, "Studies of ß-Lipoprotein of Human Plasma"; K. G. Stern, "Physical-Chemical Studies on Nucleic Acids and Nucleoproteins."

September 1 *Miscellaneous Techniques.* E. Chargaff, "Chromatographic Studies on Nucleic Acids"; Gerson Kegeles, "Diffusion and Adsorption Studies on Proteins."

The following individuals will be present by invitation: W. T. Astbury, University of Leeds; T. P. Caspersson, Karolinska Institute, Stockholm; A. G. Ogston and R. Barer, Oxford University; and D. O. Jordan, University of Nottingham.

NEWS and Notes

National Science Foundation Bill

That scientists have been, relatively speaking, temperate in their criticism of the Smith and Flood amendments to the National Science Foundation bill is evident from the reaction of the Attorney General's Office. The following letter to Senator Elbert D. Thomas from Peyton Ford, assistant to the Attorney General, dated March 6, was released to the press on March 18. It states the case against the amendments even more effectively than was done by the scientists:

The legislation to establish the National Science Foundation (S. 247 and H.R. 4846) has been amended within the past few days in a manner which has caused me deep concern. I refer to two amendments added by the House of Representatives to S. 247. The first of these amendments reads as follows:

(1) No person shall be employed by the Foundation and no scholarship awarded to any person by the Foundation unless and until the Federal Bureau of Investigation shall have investegated the loyalty of such person and reported to the Foundation such person is loyal to the United States, believes in our system of government, and is not and has not at any time been a member of any organization declared subversive by the Attorney General or any organization that teaches or advocates the overthrow of our Government by force and violence.

The second amendment provides:

(m) No person a national of a foreign country shall be associated with the Foundation in any capacity whatsoever unless and until the Federal Bureau of Investigation, independent of any investigation made by the government of such person, shall have investigated such person and reported to the Foundation that such person is not and has not at any time been a member of any organization that teaches or advocates the overthrow of the Government of the United States by force and violence.

I, of course, am firmly of the belief that disloyal persons should not be in the employ of the National Science Foundation. The amendments, however, go beyond this. Should they be enacted into law they would not only effect an extremely radical and undesirable change in the basic responsibilities and functions of the Federal Bureau of Investigation but also, in my opinion, they would bring about a departure from American concepts of justice and democratic government.

The Bureau is at the present time solely an investigative and fact-gathering agency; it does not evaluate or make recommendations with reference to the information it collects through its investigations. In loyalty investigations, as in others, the Bureau submits the information it has obtained through investigation for the consideration of the employing agency and for such determinations by that agency as may be required. The fine reputation which I believe the Bureau enjoys today as an impartial investigative agency results in large part because it has carefully restricted its activities to the making of investigations. Indeed, while the Bureau's expertise and high qualifications in this field would be challenged by no one, it is not equipped to go beyond the field of investigation and into that of making the determinations called for by the amendments. If the Bureau were called upon to perform the functions required by the amendments, its efficiency and good reputation as an investigative agency would be seriously impaired.

The enactment of either of the amendments mentioned above would remove the Bureau from its position as an impartial fact-gathering organization and impose upon it the responsibility for making decisions concerning the loyalty of individuals under consideration by the National Science Foundation for employment or for a fellowship under the act. To place the Bureau in the position of an evaluating agency regarding the loyalty of persons affected by this legislation is fraught with peril, not only to the Bureau itself, but also to the country at large. In the opinion of the Director of the Federal Bureau of Investigation, with which I agree, such legislation would constitute a clear departure from accepted fundamental theories of American government and lay a foundation for criticism of the Bureau as a state police organization.

It is also to be noted that the amendments, in precluding the employment of, or the awarding of a scholarship to, any person who has "at any time been a member of" any subversive organization seeks to deny to the Foundation the services of many Americans of unquestionable loyalty to the United States and its form of government who innocently joined a so-called "front" organization with the highest motives and who withdrew their membership from such organization upon their first suspicion of its subversive character.

It is characteristic of many "front" organizations that their purported purposes and programs are designed to appeal to loyal Americans and frequently it is behind a screen of respectibility, loyalty, and even patriotism that subversive activities are carried on, often by only a few disloyal persons. In other instances a small minority subvert an organization of previously good purposes and having many members of unquestionable loyalty to the United States. This amendment would unjustly penalize many completely loyal Americans who innocently joined such organizations and would, in some measure, tend to defeat the carrying out of the purposes of the act.

The amendments also overlook the fact that under the employee loyalty program membership in an organization on the Attorney General's list is regarded as merely one piece of evidence pointing to possible disloyalty. The loyalty program enables an employee who is a member of a listed organization to respond to charges against him and to show that his membership is innocent and does not reflect upon his loyalty. This opportunity to defend oneself in a manner consistent with American concepts of justice and fairness is lacking from the amendments.

It is also to be noted, with regard to the second amendment above quoted, that a very practical difficulty exists with respect to the proposed investigation of foreign nationals by the Federal Bureau of Investigation, in that the Bureau does not have facilities for conducting investigations abroad.

For the reasons above stated, I request and hope that you will make every effort to eliminate the amendments in question before final enactment of the "National Science Foundation Act of 1949," thus leaving investigations of the personnel of this agency to be conducted on the same basis as investigations of personnel of other non-sensitive agencies.

I am authorized to state that this letter also reflects the views of the Secretary of Defense.

The Director of the Bureau of the Budget has advised that there is no objection to the submission of this recommendation.

About People

Kendall B. Corbin, professor of neuroanatomy in the Mayo Foundation, Graduate School, University of Minnesota, was appointed associate director of the Mayo Foundation in Rochester on January 1. Dr. Corbin will continue active medical practice as a consultant in neurology in the Sections on Neurology and Psychiatry of the Mayo Clinic.

C. Howard Baltzo, assistant chief of the Branch of Fisheries, Washington, D. C., has been appointed assistant regional director of the Fish and Wildlife Service of the U. S. Department of the Interior in Alaska.

Robert B. Lewy has been appointed commanding officer of the 427th General Hospital, a U. S. Army reserve unit sponsored by the University of Illinois College of Medicine. Dr. Lewy is a clinical assistant professor of ear-nose-throat at the university, and has been a member of the faculty since 1937. He succeeds **John B. Youmans.**

Carlyle Jacobsen, executive dean of the Division of Health Sciences and Services at the State University of Iowa, has been appointed executive dean for medical education, New York State University. He will assist President Eurich and the board of trustees in establishing policies for the university's two medical centers, the Long Island College of Medicine and the Syracuse College of Medicine.

Francis Sargent Cheever has been appointed professor of microbiology in the Department of Epidemiology and Microbiology at the University of Pittsburgh, effective July 1. Since 1946 Dr. Cheever has been associate in bacteriology and Silas Arnold Assistant Professor of Bacteriology and Immunology at Harvard Medical School.

Dean Burk, head of the Cytochemistry Unit, National Cancer Institute, Bethesda, Maryland, and **Arthur L. Schade,** chief biochemist, Overly Biochemical Research Foundation, New York City, left this month for a period of research with Otto Warburg, director of the Kaiser Wilhelm Institute for Cell Physiology, Berlin-Dahlen, Germany.

Visitors to U. S.

Harold Norinder, director of the High Tension and Electricity Research Institute of the University of Uppsala, Sweden, is at the University of Chicago to participate in the research project on lightning study being conducted for the U. S. Air Force.

W. R. Lane, Chemical Defense Experimental Establishment, Porton, England, and **G. O. Langstroth,** Experimental Station, Suffield, Alberta, Canada, will present papers at the symposium on aerosols to be held at the Army Chemical Center, Maryland, April 3–5.

Gregor Wentzel, professor of physics at the University of Zurich, was a recent visitor at the Illinois Institute of Technology.

Sze Tsen Hu, of Academia Sinica, Shanghai, China, has been appointed lecturer at Tulane University.

Grants and Awards

The American Heart Association has awarded 46 grants totaling $220,000 to universities, hospitals, institutes, and laboratories, for research in heart disease. Seven are renewal grants. Among the larger new grants are: University of Southern California, School of Medicine, $8,820 for study of hypertension, *Douglas R. Drury* and *Leo A. Sapirstein*; Harold Brunn Institute for Cardiovascular Research, San Francisco, $6,300 for study of arteriosclerosis, *Meyer Friedman*; Tulane University of Louisiana School of Medicine, New Orleans, $9,135 for study of physiology of the kidney, *Nathaniel B. Kurnick*; Children's Hospital, Boston, $10,500 for study of methods for grafting blood vessels, *Robert E. Gross*; Marine Biological Laboratory, Woods Hole, Massachusetts, $8,000 for study of the mechanism of muscular contraction, *Albert Szent-Györgyi*; Cornell University Medical College, New York, $8,085 for physiological studies, *Robert F. Pitts*; Western Reserve University School of Medicine, Cleveland, $10,395 for study of metabolism of heart muscle, *Victor Lorber.*

The $5,000 Passano Foundation Award for 1950 will be conferred upon Edward C. Kendall and Philip S. Hench, of the Mayo Clinic, for their chemical investigation of the adrenal cortical hormones and the development of cortisone and its clinical application to rheumatic diseases. The presentation will be made June 28 at the annual award dinner to be held this year in San Francisco. The Passano Foundation was established in 1943 by the Williams and Wilkins Company to aid in the advancement of medical research, particularly of possible clinical application. The five previous awards have gone to E. J. Cohn, of Harvard University, Ernest Goodpasture, of Vanderbilt University, Selman Waksman, of Rutgers University, a joint award to Helen B. Taussig and Alfred Blalock, both of Johns Hopkins University Medical School, and Oswald T. Avery, formerly of the Rockefeller Institute for Medical Research.

Fellowships

The National Research Council announces the availability of funds for fundamental research in the field of radiology. Applications for research grants and fellowships during the year beginning January 1, 1951, will be accepted until September 15. Stipends are from $3,000 to $5,000, depending upon the qualifications and circumstances of applicants. Funds are not limited to U. S. citizens or U. S. laboratories. Inquiries should be addressed to the Secretary, Division of Medical Sciences, National Research Council, 2101 Constitution Avenue, Washington 25, D. C.

Two John G. Bergquist fellowships of $900 each for the study of chemistry in Sweden in 1950–51 have been announced by the American Scandinavian Foundation, 116 East 64th Street, New York City.

The Fulbright Exchange Program will be extended soon to include Australia, Egypt, Iran, Turkey, and India. Persons wishing to apply for an award as advanced research scholar or visiting lecturer in any of these countries should write to the Committee on International Exchange of Persons, Conference Board of Associated Research Councils, 2101 Constitution Avenue, Washington 25, D. C. Application forms and information will be sent on request.

Applications for Fulbright awards in the United Kingdom and British Colonial Dependencies, Belgium and Luxembourg, France, Greece, Italy, The Netherlands, Burma, The Philippines, New Zealand, and Norway, for the academic year 1951–52, will be available by late summer.

There is still time to make arrangements under the Fulbright Program for foreign lecturers to teach in U. S. universities and colleges dur-1950–51. Information may be obtained from the Conference Board Committee.

Announcement of awards for 1950–51 will be made by the Department of State on behalf of the Board of Foreign Scholarships in April or May.

Colleges and Universities

The Massachusetts Institute of Technology has announced that Horace S. Ford, principal financial officer for 36 years and treasurer of the MIT Corporation since 1934, and Edward L. Moreland, executive vice president since 1946, will retire in July. Members of the faculty retiring on the same date are: Ralph G. Hudson, member of the Department of Electrical Engineering since 1907; Frederick G. Keyes, professor of physical chemistry, MIT staff member since 1910; Donald S. Tucker, professor of economics, associated with MIT since 1919; Victor O. Homerberg, professor of physical metallurgy, who started out as an assistant chemist in 1918; and Frederick K. Morris, professor of geology, who has been with the institute since 1927.

The following appointments have been made to the biology staff at the **University of California, Santa Barbara College:** Maynard F. Moseley, instructor in botany, formerly instructor at Cornell University; Donald M. Wootton, instructor in zoology; and Robert E. Burns, instructor in botany.

The Stanford University School of Medicine is presenting its 68th annual course of popular medical lectures at Lane Hall, Sacramento Street, San Francisco. The three forthcoming lectures are: April 5—"Present-Day Treatment of High Blood Pressure," by Francis L. Chamberlain; April 19—"The Common Cold," by Rodney R. Beard; April 26—"ACTH, the Magic Hormone," by William C. Kuzell. The first lecture in the series, "New Drugs in Tuberculosis," was given March 29 by H. Corwin Hinshaw.

The Illinois Institute of Technology student chapter of the American Chemical Society will sponsor a joint meeting and symposium May 6 for chemistry and chemical engineering students in the Chicago area. A prize will be awarded to the person presenting the best paper, as judged by three professional chemists. Three-hundred-word abstracts of papers must be submitted to the selection board by *April 21.*

Harvard University has established a new laboratory of Physical Chemistry Related to Medicine and Public Health to apply physical and chemical theory and methods to problems related to health and medicine. Research will center on the study of proteins and the major structural and functional elements of plant and animal cells and tissues. The laboratory will be headed by Edwin J. Cohn, University Professor at Harvard. Powell M. Cabot, chairman of the Massachusetts Development and Industrial Commission, has been appointed business manager.

Cornell University is conducting a scientific study to determine the "attitudes and values of American college students," with the support of a $15,000 grant by the Carnegie Corporation of New York. Robin M. Williams and Edward A. Suchman of the Department of Sociology and Anthropology are supervising the project, described as "a pioneering attempt to understand the college student as a member of a real community."

The University of Colorado's High Altitude Observatory has installed a specially designed heliostat which permits photographing the sun's image at regular intervals, to record "flares" for study. The camera used contains a filter which transmits a band of light four-tenths angstrom unit wide, permitting finer recordings than have previously been made.

Meetings and Elections

The American Society for the Study of Sterility will hold its sixth annual conference at the Sir Francis Drake Hotel, San Francisco, June 24–25. Papers will be presented on mammalian aspects of infertility, gynecic aspects of infertility, basic studies on the role of the male in sterility, and standards and therapy in the male. Registration fee for the two full-day sessions is $10 and includes a detailed program containing abstracts of papers. Applications for registration should be sent to the American Society for the Study of Sterility, 20 Magnolia Terrace, Springfield 3, Massachusetts.

The fourth annual symposium on fundamental cancer research of the University of Texas' M. D. Anderson Hospital for Cancer Research will be held at the Texas Medical Center, Houston, May 12–13 in conjunction with a cancer pathology conference of the University of Texas Postgraduate School of Medicine. The College of American Pathologists will hold its south central regional meeting in Houston at the same time and will participate in the symposium and pathology conference. Among the speakers at the meetings will be A. C. Broders, Mayo Clinic, Marshall Brucer, Oak Ridge Institute of Nuclear Studies, and C. P. Rhoads, Memorial Hospital, New York City. Further information may be obtained from William O. Russell, 2310 Baldwin Street, Houston, Texas.

The Association of Geology Teachers will hold its tenth annual meeting at the University of Illinois April 14–15. The meeting is open to all those interested in the teaching of geology. Inquiries and reservations for the luncheon and dinner on Friday should be addressed to Prof. Paul R. Shaffer, Department of Geology, University of Illinois, Urbana.

An International Conference on Spectroscopy at Radiofrequencies will be held at Amsterdam September 18–23. Lectures and discussions are planned on nuclear, paramagnetic, and ferromagnetic resonance, and on precision determination of atomic and molecular constants by radiofrequency methods. Information can be obtained from the secretary of

the organizing committee, J. de Boer, Bunsenstraat 98, Amsterdam-O.

The Sixth International Congress of Pediatrics will be held in Zurich in July. Lectures and exhibitions will be held from July 21–30, and plenary sessions will be held July 24–28. Information may be obtained from the American Express Company.

The American Philosophical Society will hold its annual meeting in Philadelphia April 20–22. On April 20 at 8:30 p.m. the Penrose Memorial lecture will be given by Edwin G. Nourse. Officers and members will be elected at the annual executive session April 22 at 10 a.m.

The Centre National de la Recherche Scientifique announces that a symposium on **fundamental particles and nuclei** will be held in Paris, April 24–29. U. S. scientists who have been invited to participate are: R. P. Feynman, Cornell University; W. Pauli, A. Pais, C. Uhlenbeck, E. P. Wigner, J. Von Neumann, and W. Bargmann, of the Institute for Advanced Study; E. Fermi, E. Teller, and G. Wentzel, University of Chicago; J. Schwinger, Harvard University; G. Bernardini, H. Yukawa, and I. I. Rabi, of Columbia University; R. Marshak, University of Rochester; R. Serber, University of California at Berkeley; G. Breit, Yale University; and S. Goudsmit, Brookhaven National Laboratory.

A symposium on nuclear physics of the light elements will be held at Oak Ridge National Laboratories on June 8 and 9. S. K. Allison, University of Chicago, and R. G. Herb, University of Wisconsin, will act as chairmen. The invited speakers are: H. H. Barschall, University of Wisconsin; T. W. Bonner, Rice Institute; W. W. Buechner, Massachusetts Institute of Technology; R. F. Christy and W. A. Fowler, California Institute of Technology; and A. Hemmendinger, Los Alamos. Inquiries may be addressed to the Director of the Physics Division, Oak Ridge National Laboratories, P. O. Box P, Oak Ridge, Tennessee.

Deaths

Edwin Bayer Branson, professor emeritus of geology at the University of Missouri, died March 12, at the age of 73. Dr. Branson was chairman of the Department of Geology at the university from 1910 until his retirement in 1947. He was a Fellow of the AAAS.

Carl H. Wedell, associate professor of psychology and director of the Bureau of Industrial and Applied Psychology, University of Wisconsin, was killed in an automobile accident near Green Bay, Wisconsin, February 21. He was 43 years old.

Arthur J. Dempster, professor of physics at the University of Chicago since 1927, died March 11 of a heart attack while vacationing in Florida. He was 63 years old. Dr. Dempster was the discoverer of uranium 235 and an authority on mass spectroscopy. He was the winner of the AAAS $1,000 award in 1929 for his paper on "The Reflection of Protons from a Calcite Crystal."

V. A. C. Henmon died at Wichita, Kansas, January 10 at the age of 72. He served at the University of Wisconsin as director of the School of Education from 1916 to 1926, and as professor of psychology from 1927 to 1948.

Miscellaneous

The Southwest Research Institute has established an office in Paris, headed by Servan G. Cantacuzene, research engineer, to facilitate European work in industrial and agricultural research. Previous work has been carried on through three offices in the U. S. The Paris office will also handle European matters for the Institute of Inventive Research and the Foundation of Applied Research, the other two nonprofit institutions founded by Tom Slick, Texas oilman.

The Arctic Institute of North America announces the following change in its lecture program to be held at Johns Hopkins University (see *Science,* March 3, p. 243). Capt. P. W. Roberts, USN, will give his lecture, "Engineering Problems of the Arctic," on *May 18* instead of *April 13.* M. C. Shelesnyak, director of the institute's Baltimore-Washington office, will speak on *April 13.* His subject is "Arctic Research Laboratory at Point Barrow."

Recently Received—

British Museum Natural History Bull. 1 and 2, Vol. 1, Geological Series. ***A Reconsideration of the Galley Hill Skeleton.*** K. P. Oakley and M. F. Ashley Montagu. ***The Pterobranch* Rhabdopleura *in the English Eocene.*** H. Dighton Thomas and A. G. Davis. British Museum, London.

Safe Handling of Radioactive Isotopes. U. S. Dept. of Commerce Handbook 42. Sept. 1949. U. S. GPO Washington 25, D. C. 15 cents.

Majuro: A Village in the Marshall Islands. Alexander Spoehr. Fieldiana: Anthropology. Vol. 39. Chicago Natural History Museum, Chicago. $3.50.

Atomic Energy Commission 7th Semiannual Report, 1950. U. S. GPO, Washington 25, D. C.

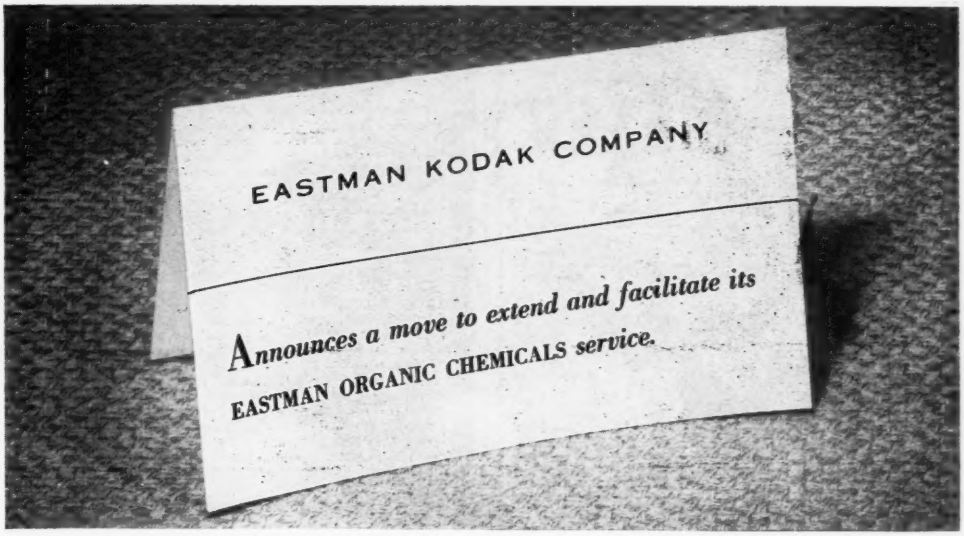
Bibliography of Technical Reports. Vol. 13, No. 2. U. S. Department of Commerce, Office of Technical Services, Washington 25, D. C.

Forest Management. C. D. Orchard. Dept. of Lands and Forests, British Columbia Forest Service, Victoria, B. C.

Annotated Distributional List of Ferns and Flowering Plants of San Diego County, California. Ethel Bailey Higgins. San Diego Society of Natural History.

Development of Dairy Breeds for the Tropics. A. O. Rhoad. Publ. 33, Inter-American Institute of Agricultural Sciences. Turrialba, Costa Rica.

An Exposure of the Triassic Eastern Border Fault. Ralph E. Digman. Misc. Series No. 2, State Geological and Natural History Survey of Connecticut. State Library, Hartford.



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MOLDS, YEASTS, and ACTINOMYCETES
Second Edition. By the late ARTHUR T. HENRICI. Revised by CHESTER W. EMMONS, CHARLES E. SKINNER, and H. M. TSUCHIYA, *1947. 409 pages. 136 illus. $5.00.*

LABORATORY MANUAL for GENERAL BACTERIOLOGY
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By R. H. WESTVELD, *1949. 590 pages. Illus. $6.00.*

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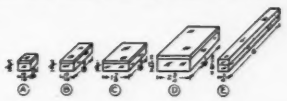

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(The Market Place is continued on next page.)

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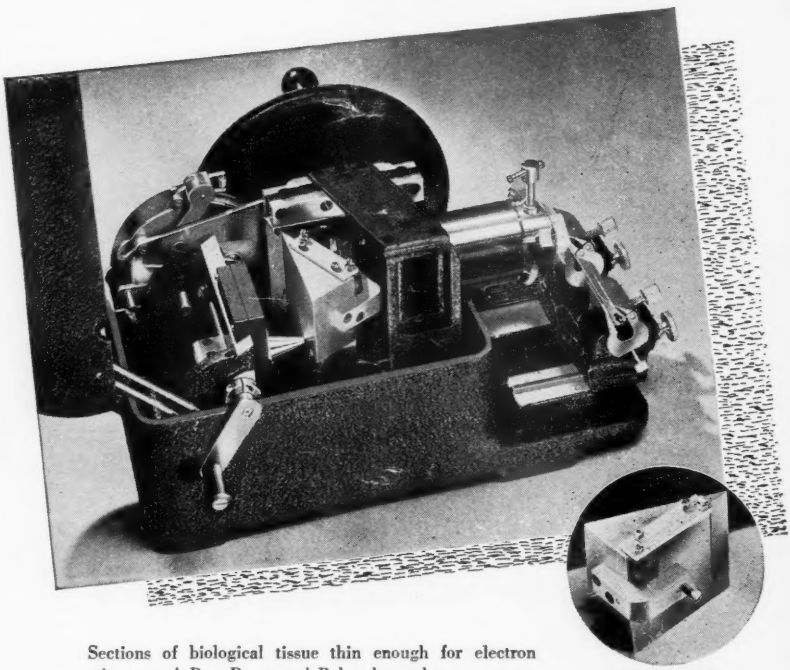

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